# MODERN Machine Shop

HOWARD CAMPBELL, Editor

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MODERN Machine Shop

CINCINNATI, OHIO VOL. 9, NO. 2

JULY, 1936

# Interesting Operations in the Building of the Norge Refrigeration Unit

BY HOWARD CAMPBELL

REFRIGERATING units or ice machines of the larger commercial type had been in successful operation long before the smaller, or household, units were placed on the market, refrigeration engineers having for many years had the idea that a small unit could not be operated successfully due to the difficulty of holding the gas under the necessary compression. Refinements in modern manufacturing tools and equipment have, however, eliminated this difficulty and domestic refrigerating units have been a success now for quite some time.

The manufacture of the modern household refrigerating unit involves some very fine work and some very interesting operations. This article, presented through the courtesy of the Norge Corporation, Detroit, Michigan, presents some of these operations in detail.

Among the more important working parts of the Norge compression

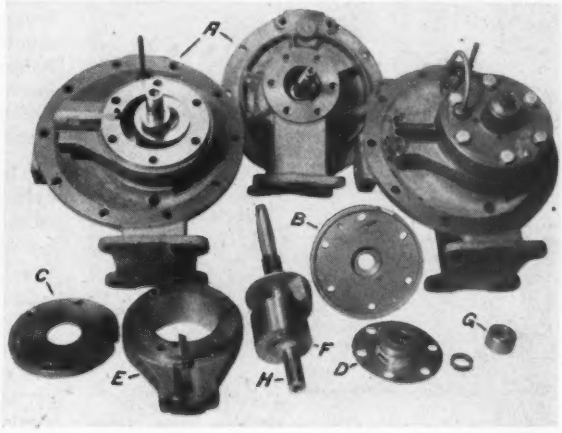



Fig. 1—Some of the more important parts of the Norge domestic refrigerator unit.

unit are the compressor body, indicated at A in Fig. 1, cylinder bearing plate B, cylinder discharge plate C, seal assembly D, compression cylinder E, compression rollator F, seal ring G, and eccentric shaft H.

The cylinder bearing plate, indicated at B in Fig. 1, is bored, faced, drilled, reamed, counterbored and chamfered in the Natco six station drilling machine shown in operation in Fig. 2. This machine is entirely self-contained, and is equipped with six universal chucks in which the workpieces are held. The first station is the loading station; at the second station the piece is drilled; at the third station the hole is chamfered and counterbored; at the fourth station the piece is rough bored and faced; at the fifth station it is finished, bored and faced, and the recessing operation is performed at the sixth station. Limits of 0.002 in. in the hole and 0.002 in. on the counterbore are allowed and the face must be true with the hole within 0.005 in.

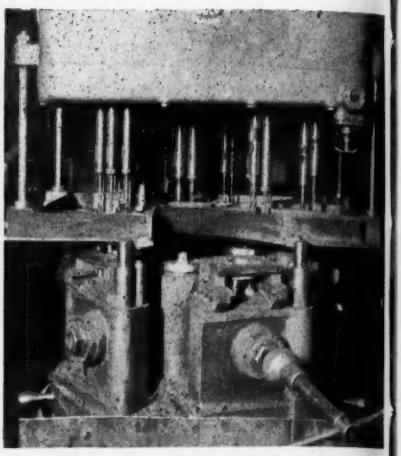


Fig. 3—Twelve holes are drilled and six are spotfaced in the cylinder bearing plate in machine.

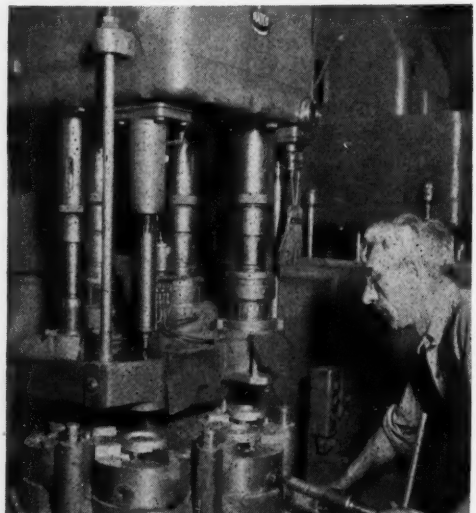
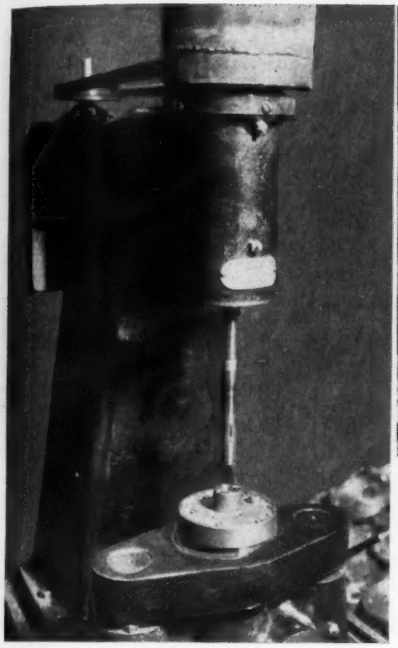


Fig. 2—This Natco drilling machine bores, faces, drills, reams, counterbores and chamfers the cylinder bearing plate.

Figure 3 shows a Natco multiple spindle machine set up for drilling all the holes in the cylinder bearing plate. These include six 21/64 in. holes, four holes 3/16 in., and two 7/32 in. holes. The 21/64 in. holes are spot faced 11/16 in. diameter.

The shaft bearing hole in the cylinder bearing plate is reamed to 0.614 to 0.615 in., diamond bored to 0.6251/0.6254 in. and then is bearingized to 0.6255/0.6258 in. The bearingizing operation is performed with the tool shown in Fig. 4. The bearingizing tool can best be described by saying that it is designed on the principle of a swaging machine turned inside-



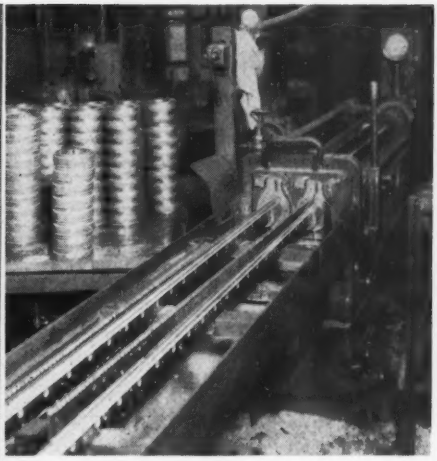


Fig. 4—(Left) Equipment with which the shaft hole in the cylinder bearing plate is "bearingized." In this process a hard, burnished surface is produced which is held to within 0.0003 in. of the drawing dimensions.

Fig. 5—(Above) Broaching a 0.250 in. slot 1 29/32 in. deep in each of two compressor cylinders.

out. The body of the tool is an arbor upon which are machined a series of cam surfaces and surrounding this section is a retaining cage containing a number of accurately-made small rolls. With the spindle of the machine running at a high rate of speed, the bearingizing tool is inserted into the hole and as the tool revolves in the hole, the cam surfaces strike the rolls and drive them against the wall of the bore, compressing the metal and closing the pores. In this process a hard, burnished surface is produced which is held, for accuracy, to within 0.0003 in. of the drawing dimension.

The operation is extremely rapid, only one pass being required at a rate of speed comparable to hand feed reaming. The operation of the bearingizing tool is facilitated by the use of a mixture of machine oil and kerosene.

The broaching equipment illustrated in Fig. 5 is interesting, not so much because broaching is unusual as because of the accessory equipment used with the broach and shown in Fig. 6. The operation is that of broaching a 0.250 in. slot in the compressor cylinder as indicated in the drawing Fig. 7. This slot, being actually

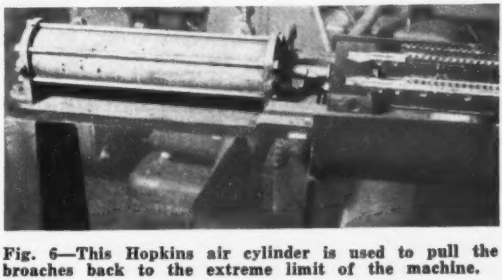


Fig. 6—This Hopkins air cylinder is used to pull the broaches back to the extreme limit of the machine.

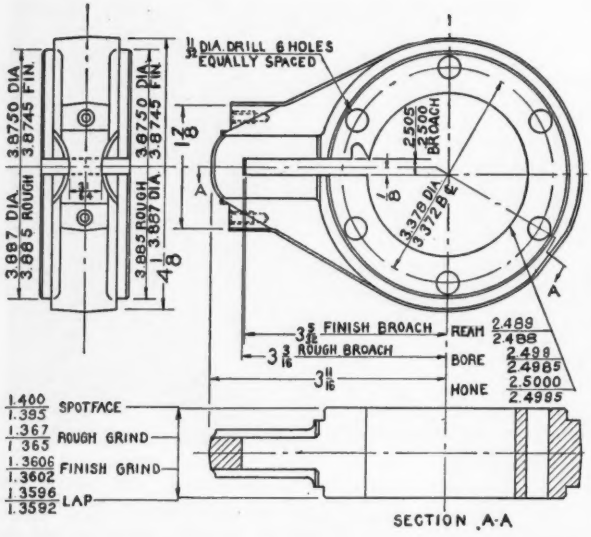



Fig. 7—Drawing of Compressor Cylinder.

1 29/32 in. deep, necessitates two operations on a double broach, one broach machining half the slot and the other broach finishing the slot to the full depth. However, even with two broaches the slot is so unusually deep that the broaches do not draw back on the return stroke to a point which will afford sufficient clearance for changing the workpieces in the machine, consequently the machine is aided by the air cylinder shown in Fig. 6.

When the broaches reach the limit of reversal, the ends slip into two slots in a block that is attached to the end of the piston rod of a Hopkins air cylinder. As the ends of the broaches enter these slots, spring pins engage grooves which have geen ground vertically in the sides of the broaches and thus hold them with sufficient pressure so that, when air is admitted to the cylinder, the broaches are pulled back an added distance as the piston rod retreats into the cylinder. With the broaches back this extra distance, clearance is afforded for changing the workpieces in the machine and then as the air valve is once more operated, the piston pushes the broaches forward to a point where they will be engaged by the machine mechanism and will proceed with the broaching operation. The air cylinder is controlled by means of a Ross valve.

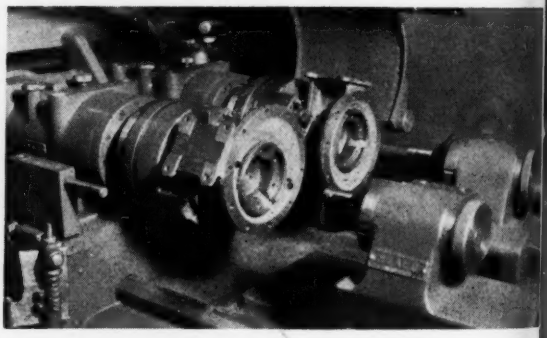


Fig. 8—Shaft bearing holes in compressor bodies are bored in this "Heald Red Head" diamond boring machine. The holes are finished to 3.505 in. within a tolerance of 0.0003 in.

The parts set up in the machine shown in Fig. 8 are compressor bodies

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## MODERN TOOL WORKS

*Division of Consolidated Machine Tool Corporation*

**561 BLOSSOM ROAD** **ROCHESTER, N. Y.**

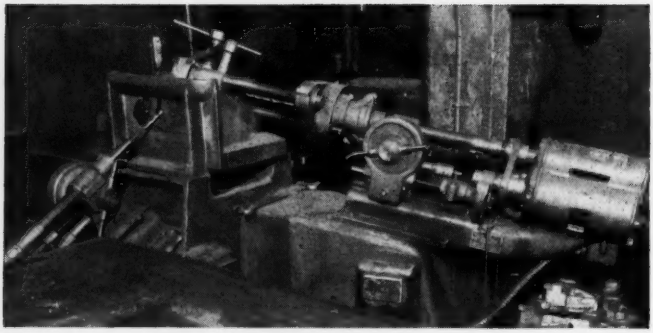

Fig. 9 — Drilling machine comprising two Avey independent drilling units, arranged so that the chips will fall out of the drilled holes by gravity.

and the machine is a double spindle Heald diamond boring machine, arranged to bore the shaft bearing holes in the bodies. The shaft bearing hole is finished to a diameter of 3.505 in. with a total tolerance of 0.0003 in. Tungsten carbide is used for tools on this operation, producing practically a mirror finish.

An interesting piece of equipment is illustrated in Fig. 9, this machine comprising a base to which are attached two independent Avey drilling units. The units, as can be seen from the illustration, are set so that the drills are pointed slightly upward, which is a necessity in this case.

The drills are 5/16 in. and ⅜ in. diameter and one of the holes is 3¾ in. deep while the other is approximately 3½ in. in length. In drilling holes of these unusual depths, it is necessary to withdraw the drills at frequent intervals in order to avoid clogging the holes with chips and breaking the drills. By setting these units and the work fixture so that the drills point slightly upward, the chips work back and fall out of the holes by gravity, thus leaving the drills free and saving time which would be spent in pulling the drills out of the holes to clear the chips. Inasmuch as the drills must of necessity each be 6½ in. long, drill breakage would run into money in a very short time. The drills operate at a speed of 1200 r.p.m.

The machine shown in Fig. 10 is a Natco tapping machine, tapping 14 holes in various parts of the compressor body. All of these holes are drilled in one operation, the spindles

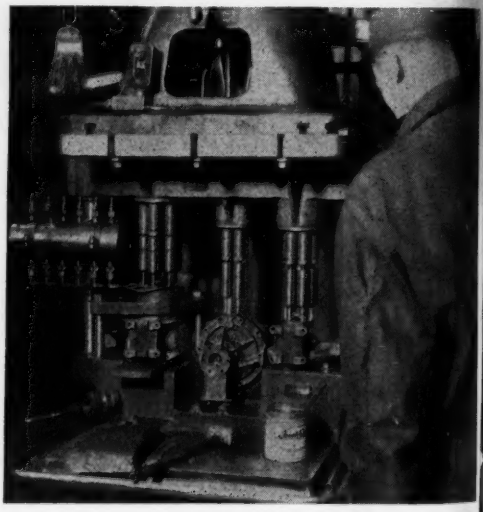

Fig. 10—Tapping 14 holes in the compressor body. Six of the taps are guided by means of bushings, all being supplied from a Lunkenheimer oiler.

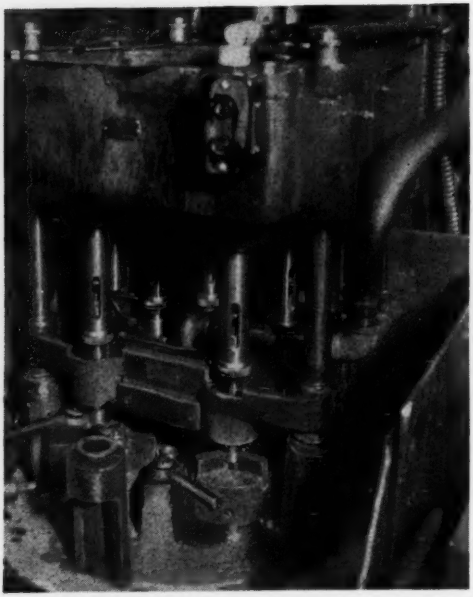

**Fig. 11—Machining seal rings. The limit on the hole is 0.0003 in. and the face must be square with the bore within 0.0002 in.**

being so arranged that six holes are tapped in one side, three in another side, and five in another side at the same time, fixtures being arranged so that the operator can place the three pieces in their respective positions.

Six of the holes must be extremely accurate, therefore the six spindles carrying the taps for the holes are guided by means of a bushing plate. Inasmuch as the bushing plate prevents reaching the taps with a brush for oiling, as is customary, oil is supplied to these six taps by means of a Lunkenheimer oiler, the oil flowing to the taps through the tubes from the six outlets of the oiler.

The multiple spindle machine shown in Fig. 11 is set up to rough and finish ream the center hole, counterbore, face, chamfer, face the opposite end, counterbore the opposite end, turn, and face the opposite end of the bronze seal ring indicated at G in Fig. 1, ten operations in all being performed on this piece in this machine. The work pieces are held in small universal chucks, each chuck being operated by a wrench that is controlled, through bevel gears, by a handle conveniently placed to the chuck. Thus each chuck has its own chuck wrench and operating handle, making it possible to release the workpiece, change it and lock the new piece in the chuck in a couple of seconds.

In the first round of operations the piece is reamed, two chamfering operations are performed, a counterboring operation is performed, and a facing operation. The piece is then turned over and in the next round of operations it is finished on the opposite end. The face must be square with the bore within 0.0002 in. total indicator reading and the face must be free from scratches or tool marks of any kind. The total limit is 0.0003 in. on the holes.

**(To be concluded in the August issue)**

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**ALLIS-CHALMERS SINGLE SUCTION END INLET CENTRIFUGAL PUMPS.** Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin, has issued a new leaflet 2224 on their single suction end inlet centrifugal pumps, mounted on substantial pedestals, and used with direct connected or with Texrope V-belt drives. These pumps are bronze fitted and range in size from 1¼x1¼ to 5x4, for heads up to 100′ and over, with many applications in most every industry. In addition to showing the general construction with dimension tables, this leaflet shows a number of typical combination drives. This type of pump can be furnished suitable for use in an inclined or vertical position, as well as horizontal.


# Replace *your present inefficient turret lathes* . . . . . with new high speed Warner & Swasey *Turret Lathes.*

ENGINEERED to "profit paying" standards. High Speed Warner & Swasey Turret Lathes go a step farther than meeting your demands. They satisfy your operator as well . . . help him decrease the cost of goods and increase his earning potential, *with much less effort.* Gain all these advantages by profitably replacing your present inefficient turret lathes with new High Speed Warner & Swasey Turret Lathes.

You may say your problem is different — good! No two problems in turning are exactly alike, however we will gladly analyse your problem and present the dollar facts.

A wire or letter will receive our prompt attention.

WARNER & SWASEY . *Turret Lathes* . Cleveland, Ohio

# Suggestions Win Awards at General Electric

By Wm. E. Owen

General Electric Company, Schenectady, New York.

THAT new ideas are worth money was discovered by the recipients of the 5514 cash awards made under the Suggestion System of the General Electric Company in 1935. The growth of this plan since 1926 and the $500,000 worth of awards that have been made since that time make a story that should be interesting to those managers who are desirous of capitalizing on the intelligence of the men in their plant organizations.

The first Suggestion Committee of the General Electric Company was appointed at Schenectady to develop ideas originated by the men. These men had formerly gone directly to the manager or his staff because they were not satisfied with having anyone of less importance consider them. The time consumed by this work was a burden, and the manager, in order to relieve himself of the duties, created the Suggestion Committee.

The first committee was composed of men who were to devote only a part of their time to its functions. Their meetings were irregular; frequently months passed between sessions. The reports of the superintendents on the suggestions submitted were practically final; and this fact created wide dissatisfaction among the men. Actually, the whole idea was considered as something to be tolerated; not encouraged.

Opposition to the idea was both open and active. No advertising was used to acquaint the men with the committee and no very definite stamp of approval was placed upon its functions by the management. The plan lacked the spirit of cooperation so necessary to success and yielded but few advantages to both men and management. These conditions prevailed as recently as ten years ago; therefore the "new" Suggestion System is relatively young in point of service.

The changes which have made the system the effective and respected organization that it is today were


**Type of Suggestion Box In Use at General Electric Company**

changes in routine and personnel rather than changes of basic principles. In the first place, the management pledged its unreserved support and appointed men who were particularly qualified to conduct this type of work. Further, an advertising campaign was instituted to better acquaint the men with the system and encourage them to use it. Regular weekly meetings were held regardless of the amount of work on hand, and a careful investigation was made of each suggestion before adopting or rejecting it. These reforms, with a general increase in the efficiency of handling suggestions, served to renew the interest of the men and elicit a high degree of cooperation. The usefulness of the suggestion system since that time has steadily increased.

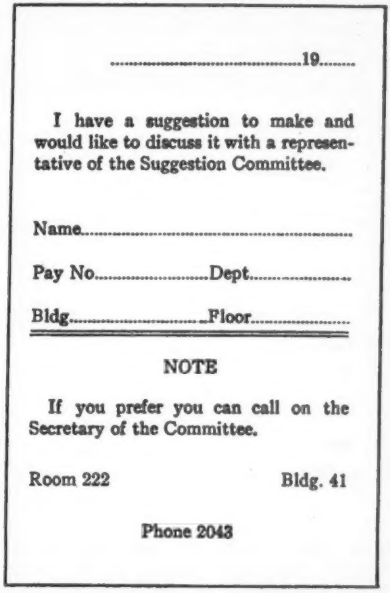
### The Present Suggestion System

At the present time standard practice for the handling of the suggestion system is not followed in all works of the General Electric Company. However, unification of this work was undertaken recently, and standardizations, as dictated by experience, are being adopted. The material which follows covers the general principles upon which the General Electric System as a whole is based, but special reference is made to Schenectady since it is the largest works.

### Suggestion Boxes

In the first place, suggestion boxes are installed at convenient points throughout the factory and offices. At first they were located in out-of-the-way places on the supposition that employees were bashful about offering suggestions. This is not the case. Placing the boxes near exits, time clocks, bulletin boards, and drinking fountains has been found to be more effective. The number of boxes provided approximates one for every 200 employees in the large plants and one for every 100 in the small plants. The type of box recently adopted as standard is shown in the accompanying photograph, the dimensions of the board behind the box being about 18 inches wide with the other dimensions in proportion.

A great variety of boxes was tried, ranging from the familiar metal rural delivery box to a simple wooden box of about the size and shape of the box proper in the photograph. The most satisfactory is that shown in which the box is mounted on a back board, which provides a rack for the display of advertising cards, one for envelopes already addressed to the Suggestion Committee, another for cards requesting a personal interview (for use by suggestors who cannot express themselves well in writing), and another for a pad of suggestion blanks upon which suggestions may be written.



.....19.....

I have a suggestion to make and would like to discuss it with a representative of the Suggestion Committee.

Name.....

Pay No.....Dept.....

Bldg.....Floor.....

NOTE

If you prefer you can call on the Secretary of the Committee.

Room 222 Bldg. 41

Phone 2043

**This 3x5-inch card can be used when a verbal discussion is necessary.**

Too much stress cannot be placed

**GENERAL ELECTRIC**

# SUGGESTION BLANK

In making suggestions, care should be taken to define and explain clearly as possible, naming article, part numbers and operations affected. When applicable to a machine or a part of a machine, please give machine number and location.

Suggestions are welcomed which will benefit the Company and its employees, reduce the cost of or increase production, improve the quality of our product, the method of manufacture, the safety of employees or general maintenance of the Plant.

**IF SKETCH IS REQUIRED MAKE ON SEPARATE SHEET**

.....

.....

.....

.....

Date.....(Signed).....

Nature of Employment.....

Pay No....., Bldg.....

Do not use other side. Use additional sheets if necessary. Receipt of this blank will be acknowledged.

FF-447-A 10m 8-15-34

**Suggestion Blank. Size 8½x11 inches.**

upon the value of the advertising posters which are placed on the boxes. These have been found so valuable in stimulating interest in the Suggestion System that a standardized service has been arranged to provide uniform cards for all Works with a monthly change of copy. In these cards an endeavor is made to avoid sermonizing and dry reading. To provide conspicuous cards which will agreeably contract with the general run of shop notices, colored cards with catchy illustrations and type treatment along the lines of the street car cards have been resorted to. Interest in the system is also maintained by publishing Suggestion News in the several works' newspapers and by talks on this subject by company officials.

Advertising is kept up continually. The problem must be tackled from every possible angle in order to break down prejudice, eliminate supervisory opposition, and most of all, overcome inertia and indifference. The object of advertising is not merely to secure suggestions, but to secure **good** suggestions.

### Collections

In the Schenectady Works, members of the patrol department make semi-weekly visits to the various boxes to gather the accumulated suggestions, which they turn over to the suggestion committee secretary. In some of the other plants, these collections are made by some member of the committee. In no case are collections made less frequently than once a week.

When suggestions are received

## RECORD OF ACTION

THIS SIDE FOR USE OF OFFICE ONLY (USE OTHER SIDE)

Date Received

File No.....

| Referred to | Date | Date Returned | REMARKS |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

**This form is printed on the reverse of the Suggestion Blank.**

from the collector by the suggestion committee secretary, they are classified according to the filing system. This is generally straight numerical filing in which the suggestions are consecutively numbered in the order in which they are received. Each suggestion is also stamped with the date of its receipt, is recorded by number, name of suggestor and sometimes by title of suggestion, and is then turned over to the department concerned for investigation.

**Investigation**

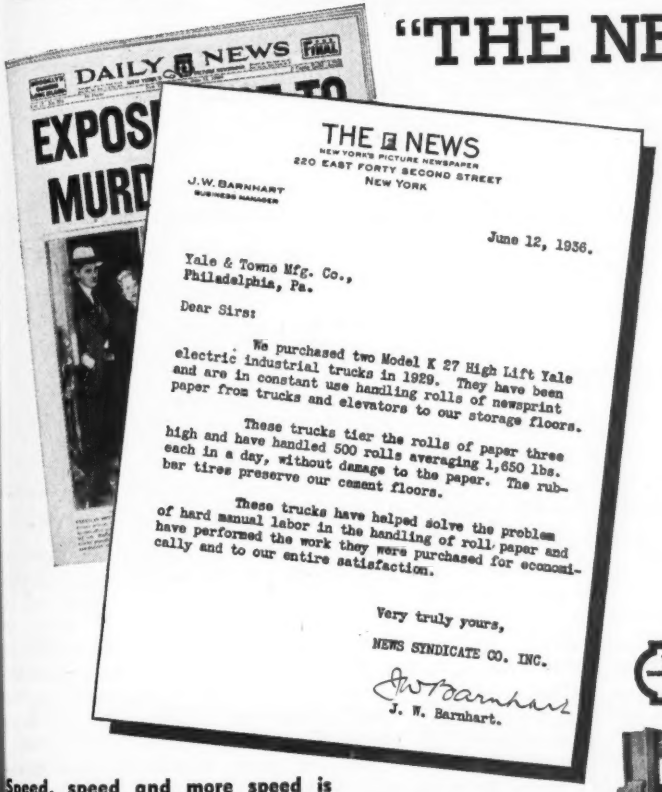
The department head usually designates a member of his own staff to investigate the suggestion. In the investigation this man always makes an effort to interview the suggestor in order to make sure that he understands what the suggestor has in mind. The report he renders states whether or not it should be adopted, and if it is possible to estimate savings, a savings figure is given. If the suggestion is worthy and no savings figure is obtainable, he estimates its value.

From the department the suggestion goes back to the committee secretary, who refers it to one of his own investigators for reinvestigation and report. If the committee investigator finds the recommendation of the department adequate and fair, he disposes of the rejection courteously and with great care by a personal interview with the suggestor; those adopted he brings before the committee with a full description of all details and a recommendation of the size of the award. If the committee investigator does not find reason for rejection, he takes the matter up with the department investigator. In all cases the suggestion committee and the department come to an agreement in regard to the suggestion. One always convinces the other.

Antagonism from some of the men in supervisory positions was experienced at first. This has been largely overcome by repeated declarations from the management that suggestions are desirable and are regarded as an indication of a department's progressiveness. Employees are encouraged to have faith in their superiors and to enlist their cooperation in attempting to make their suggestions successful.

When possible, the investigator obtains samples embodying the suggestion. Savings figures are obtained

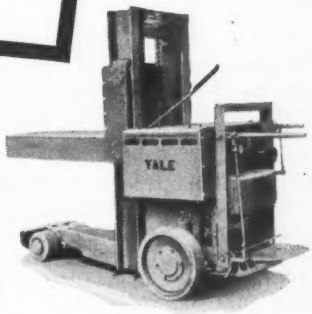
# YALE TRUCKS *speed up* "THE NEWS"




**Speed, speed and more speed is the demand in the great plant of the New York Daily News where more than a million and a half copies of The News are printed and distributed daily and nearly three million on Sunday. The letter reproduced above shows that YALE Trucks are meeting that demand. They provide, not speed alone, but the important added factors of efficiency, economy and safety.**

**A Materials Handling Survey of your plant by a YALE Expert is yours for the asking. No obligation.**

-YALE-




**YALE ELECTRIC TRUCK**

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**Providing tremendous lifting and hauling power and the durability to stand up under the highest kind of service. There are numerous other models with modifications to meet every individual plant requirement.**

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**Philadelphia Division,**
**Philadelphia, Pa., U. S. A.**

GENERAL ELECTRIC Suggestion No._____

SUGGESTION ACKNOWLEDGMENT

_____ 19____

To_____

We acknowledge the receipt of your suggestion dated_____

relative to_____

We thank you for your suggestion, and you will be advised of final action at a later date.

Keep this as a reference, using the above number.

SUGGESTION COMMITTEE

_____

FF-417-C 7500 8-9-35

**Each suggestion received is acknowledged on the above form. Size, 8½x5 inches.**

from the cost department whenever possible, since the awards granted for adopted suggestions are usually based upon estimated savings.

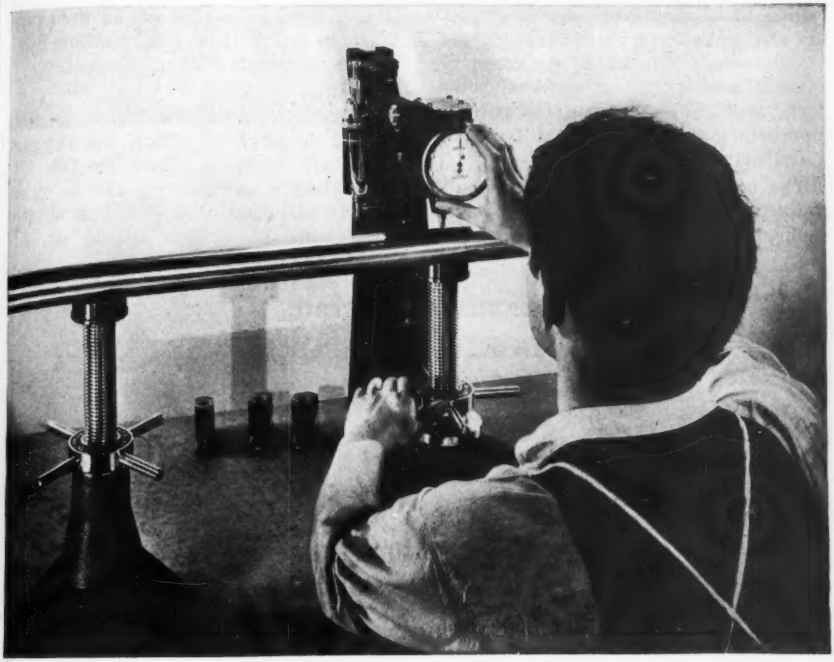
Many kinds of suggestions are received representing improvements in design, convenience, safeguards, and improvements in manufacturing methods. Some of these suggestions effect a determinable saving by reducing the cost of manufactured parts; others by improving production equipment. Still other suggestions, such as those relating to safety appliances, conveniences of employees, improvements of products and the like, do not always permit the determination of their cash values. In such cases the award is based upon an estimate of the importance of the suggestion.

It should be noted that the adoption of a suggestion, or rather the granting of an award, is not necessarily based upon the originality of the idea. It does not have to be an invention or a startling innovation. The fact that not more than five out of the 15,945 suggestions received in 1935 were patentable will serve to illustrate this point. It may even be a thing which has been suggested before but, due to negligence on the part of the supervisors, has not been applied wherever possible.

At this point it will be well to explain that obviously impractical suggestions are rejected by the secretary without being referred to the department concerned. It should also be noted that the usual practice is to exclude such employees as executives and engineers when making awards. Their suggestions are received, acted upon, and called to the attention of the heads of their department or their supervisors.

**Committee**

As stated, the adopted suggestions are turned over to the suggestion committee. This committee usually consists of a permanent secretary



**Why do you suppose it is such a simple matter to do real precision testing on the "ROCKWELL" Hardness Tester?**

**For years and years it was an unsolved problem to make reliable hardness measurements on steel, fabricated into various shapes and hardened, and on cylindrical rod, sheet metal and so forth.**

**The reason you can make such tests now, with speed, certainty and convenience is that we made it our business to put so much time, care and ceaseless effort to build the machine itself into such a simplified, rugged, precision tool that differences in readings, on machines kept in reasonable condition, will be due to differences in hardness of pieces tested.**

**We do not stop at the easier job of making comparators of hardness. We tackle the job of making real measuring machines,—which is quite another thing.**

**CONCORD AVENUE AND EAST 143rd STREET**

**WILSON**
**MECHANICAL INSTRUMENT CO., INC.**

**NEW YORK, NEW YORK.**

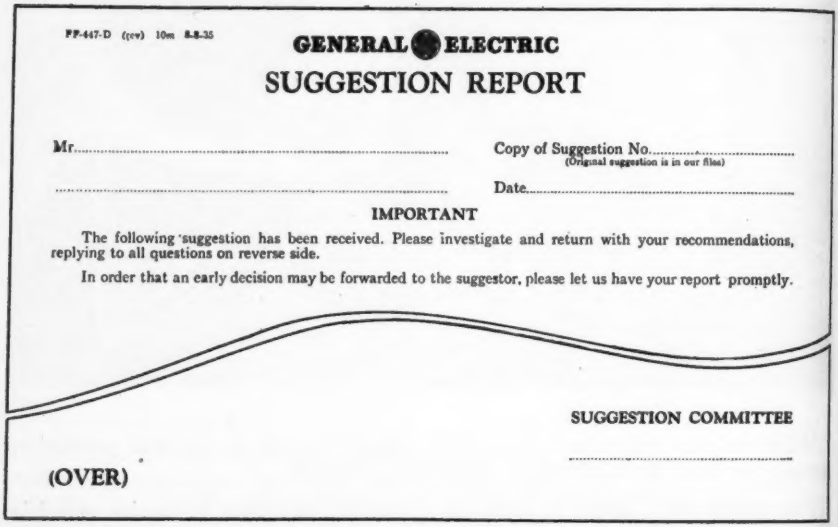
(who, in the larger plants, devotes his entire time to this work), a permanent chairman, or a chairmanship rotated among the committee members, and four or more additional members generally selected from the manufacturing organization.

The committee membership usually comprises manufacturing executives, such as the electrical and mechanical superintendents, and so on, together with any special investigators who devote their entire time to the suggestion work. It has been found good practice to include in the committee a member familiar with electrical engineering, one familiar with electrical operation or testing, one skilled in mechanical design and machine shop practice and possessing a good knowledge of machine tools, and a cost man to determine savings. In some of the works, the employees are permitted to select representatives to act with the suggestion committee in passing upon suggestions.

**Meetings**

Considerable importance is attached to the speed with which the suggestions are handled. Best results follow when a suggestion can be completely disposed of within one month. This time is always aimed at, although there are many suggestions which require greater time for a verification of their worth. In order to keep the time at a minimum, however, most of the committees meet once each week on a specified day.

The first business is to hear the secretary's report of the number of suggestions received during the week, number reported upon, number awaiting investigation, and the number pending in order to check operation or saving. Following this, the awards



FF-447-D (rev) 10m 8-8-35

GENERAL ELECTRIC

SUGGESTION REPORT

Mr..... Copy of Suggestion No.....
(Original suggestion is in our files)

..... Date.....

IMPORTANT

The following suggestion has been received. Please investigate and return with your recommendations, replying to all questions on reverse side.

In order that an early decision may be forwarded to the suggestor, please let us have your report promptly.

SUGGESTION COMMITTEE

.....

(OVER)

**This form, bearing a copy of the suggestion, is turned over to an investigating committee, who use the reverse of the sheet for the report. To aid the committee, the form carries the headings (1) Is the idea new in our practice? (2) Is it already under consideration? (3) If so, who has the matter in hand? (4) Adoption: answer "Yes", "In part", or "No". (5) Improvement in quality of product? Estimated value? (6) Reduction of material? Yearly saving? (7) Saving of labor? Yearly saving? (8) Other savings? Total yearly savings?**

granted a year previously are reviewed to see whether the suggestor received a sufficient award as determined by the year's operation. Where it seems desirable, figures are obtained and a supplementary award is granted to adjust compensation to the proper value.

A report of the pending suggestions is then made if the time determined for them has elapsed. If complete information permits, their consideration follows, and the awards are determined for those which have been granted an additional award, or, if not, is shown in detail why an additional award cannot be granted.

Special care is used in preparing letters rejecting suggestions. In each transaction, an endeavor is made to keep the suggestor satisfied; but the committee never permits itself to be bullied into making an award for a worthless idea or giving a larger award than a suggestion is worth.

**General Use**

In order that the suggestion committees in the various plants may follow a more or less standardized practice, a member of the manufacturing general department is appointed, whose duties are those of a general secretary. He keeps in close contact with all committees by correspondence and personal visits. It is his duty to supervise the general advertising and to lend assistance in helping individual committees out of their difficulties. Also, all suggestions of more than local interest are sent to his office for broadcasting to the other works in order that the greatest possible benefits may result.

If a suggestion which has been broadcast to all the works through these channels proves of considerable benefit, the suggestor is given an additional award based on these benefits.

Absolute fairness is the life of the system.

FF-447-H 3600 2-3-36

Name.....

Pay No.....Dept.....Bldg:.....Foreman.....

Suggestion regarding

Referred to.....Date.....Ansd.....
Referred to.....Date.....Ansd.....
Referred to.....Date.....Ansd.....

Sug. Closed..... Award Yes No. Amt

Annual Saving.....

Name No. Date

**A record, on a 3x5-inch card, is made regarding the disposal of each suggestion.**

adopted. The committee then considers new suggestions. These are read by the secretary or some other member of the committee, passed upon in turn, and voted awards in accordance with their merits. The awards average approximately 10 per cent of the estimated savings of the first year.

**Awards**

In most cases the suggestors are pleased with the awards and the recognition they receive for their suggestions. Occasionally, however, a suggestor is dissatisfied. In such a case, the suggestor is assured of a reinvestigation to adjust matters if possible. Following such an investigation he is interviewed again and

---

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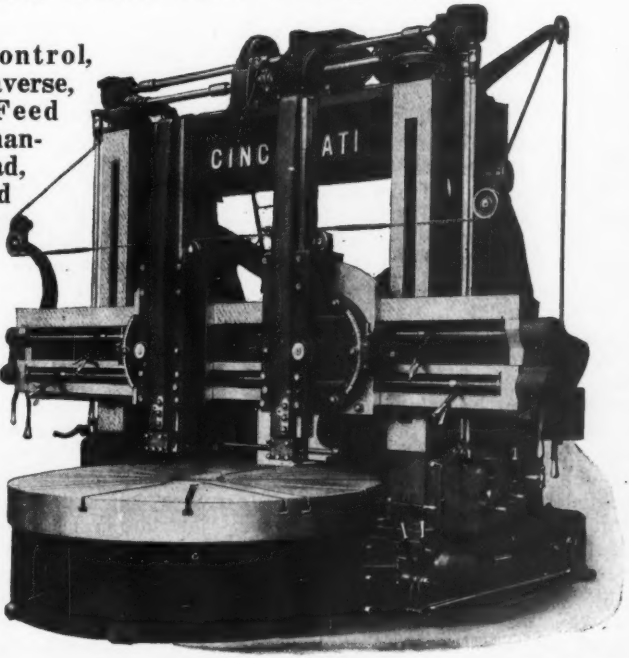


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# Methods Engineering Installation: Mapping Out the Program

By H. B. Maynard,

President, Methods Engineering Council, Inc., Pittsburgh, Pennsylvania

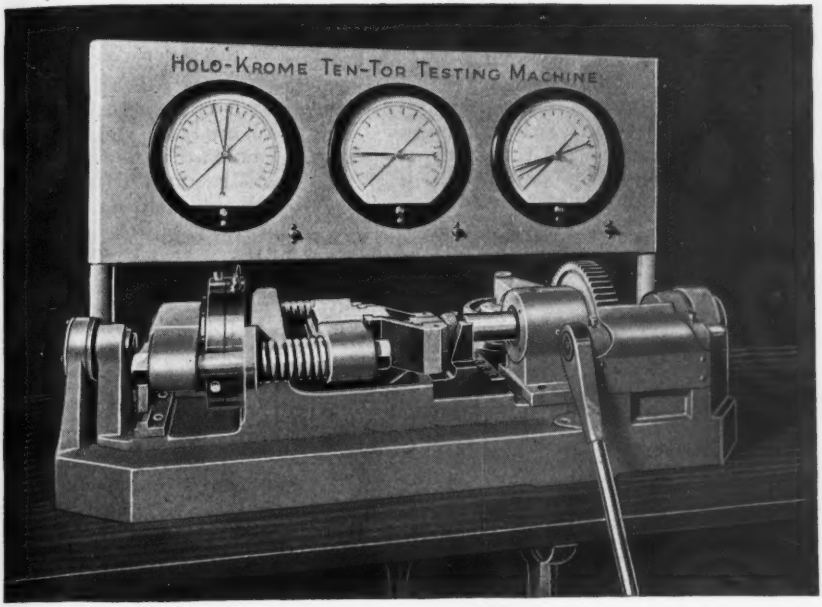
THERE are several techniques or procedures which may be used in making a methods study. These have been discussed briefly in preceding articles and are shown graphically in their relation to one another by Fig. 1. All of the procedures shown, are not used every time a methods study is made, however, for only certain classes of work justify a complete and detailed study. The more detailed the study, the greater is the amount of time required to make it. On any study, the savings effected must equal or exceed the cost of making the study, if the expenditure is to be justified from an economic standpoint.

At the outset of a methods engineering installation program, therefore, the problem of determining the kind and amount of study which is justified must be solved. The owner or the manager of a plant which contemplates beginning or extending its methods of engineering work must decide how thoroughly the work should be studied to bring about the greatest net return. It must decide to what extent motion studies are desirable, whether to equip for motion picture studies, whether to set time values by detailed time study, time formulas, or estimates, and other similar points.

These decisions can not be made off-hand with any pretense of correctness, for there are a number of factors which must be considered. It is the purpose of this article to discuss these factors and to indicate a procedure by which an owner, manager, superintendent, foreman, or methods engineer can determine with reasonable exactness the type of methods study which can be undertaken profitably on any class of work or on any individual job.

## Types of Methods Studies

There are a large number of combinations which can be made of the various techniques used by the methods engineer, and it might seem that there are an equally large number of types of study which are commonly used. The problem is not as complicated as this, however, for certain techniques logically accompany only one or two other techniques. It would be possible, for example, to make an elaborate motion picture motion study of a job and then without operator instruction set a time or a money allowance on the newly developed method by estimate. This would not be a practical combination, however, for the highly refined methods which are developed as the result of careful motion study must be taught to the operator if it is to be expected that the methods will be followed. Further, if the job justifies careful motion

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study, it also justifies careful measurement of the time element.

Thus it is found that the types of methods study commonly employed throughout industry fall into six major classes. The type which can be economically employed for the study of any job or class of work depends upon several factors which will be discussed presently. When a given type is decided upon, however, certain combinations of procedures are definitely indicated.

The six types of methods study and the procedures used for each are as follows:

**Procedures or Techniques Employed**

**Type A.** Written job analysis, using one or more types of process charts and analysis sheets. Motion study employing motion pictures. Motion time study. Standardization including motion picture training. Time Study.

**Type B.** Written job analysis, using analysis sheet. Motion study by analysis and observation. Standardization including written instructions. Time study.

**Type C.**—Mental job analysis. Standardization including verbal instructions. Time Study.

**Type D.** Written job analysis of class of work using process charts and analysis sheets for analyses of representative jobs. Motion study of representative jobs, if necessary employing motion pictures to develop best methods. Standardization including written instructions. Time Study. Time Formula.

**Type E.** Mental job analysis dur-

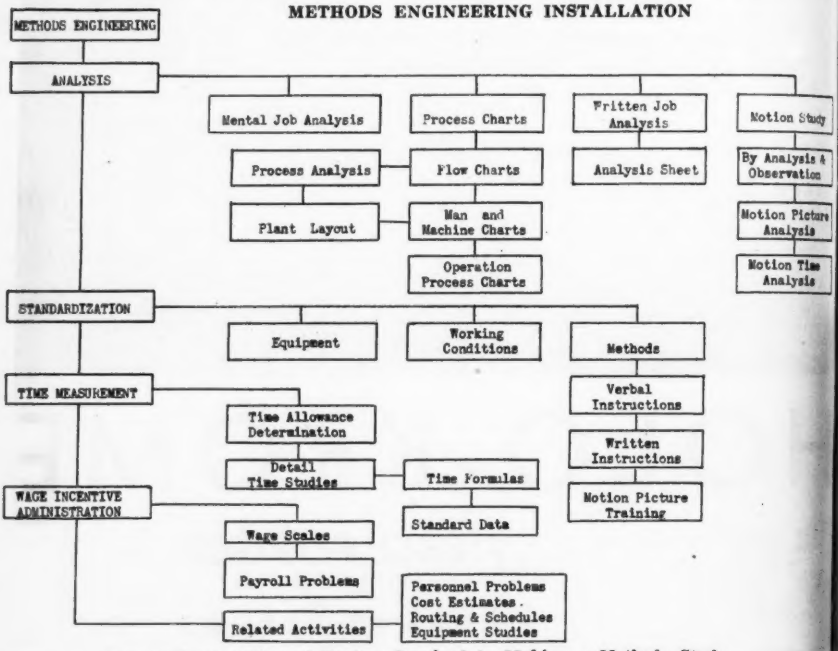


**Fig. 1—Presentation of Factors Involved in Making a Methods Study**

ing general survey of class of work. Motion study by analysis and observation during general survey. Standardization. Time Study. Time Formula.

**Type F.** Standard Data.

Types A, B, and C are applied particularly to individual jobs. Types D and E are applied to classes of work comprised of similar jobs, while type F is applied to either individual jobs or classes of work where quantities are very small.

The type of methods study which has been classed as type A goes into the study off the job in the fullest detail. Every phase of the job is considered minutely. In consequence, the largest gross savings may be expected to result from a study of this kind. The cost of making the study is at the same time relatively high, so that this thoroughness is justified on only a limited class of work.

It should be remembered that when a new and simple method of doing a job is once known, it looks so easy and so fundamentally correct that it is often difficult for those who have had no experience with methods study to understand how it could possibly ever have been done otherwise. The tendency is to attribute older and less efficient methods to lack of interest, effort, or ingenuity on the part of the workers and their supervisors. Efficient methods are easy methods, and it is difficult to grasp the amount of detailed investigation that is necessary to evolve them. It is a fact, however, that the type A methods study, which goes into the greatest refinement and requires the greatest amount of time to make, leads to the development of the simplest methods.

The type B methods study is similar to the type A with the exception that a quicker and more casual study of the motions used by the operator is made. The motion study is made by analysis and observation with the result that the improvements made are of the type which are more or less obvious. To draw an analogy, the type A methods study may be likened to higher mathematics while the type B study compares with simple written arithmetic.

The results which are obtained from the type B study depend to a large extent upon the ability, ingenuity, experience, and mental alertness of the observer. Hence the methods engineer who has had experience with making type A studies will be able to recognize possibilities for improvements as the result of his familiarity with motion times and the characteristics of motions which the less experienced observer is quite likely to overlook. In mapping out a methods engineering installation program, therefore, and when beginning work on it, it is best to employ methods engineers capable of making type A studies, even though types B or C may be all that it is profitable to make. The greater improvements which fully trained men will make during even a brief study will justify adherence to this policy.

The type C methods study is the briefest form of individual detailed study. The job is analyzed mentally and quickly, and the obvious improvements which can be made are put into effect at once. The job is then time studied without further delay. In the mathematical analogy, the type C study may be likened to mental arithmetic. It is quick to apply, but it solves only the simplest problems. Because of the quickness with which it may be made, the type C study is the most practical for work done in relatively small quantities. The chief benefit is obtained from getting the work performed with an incentive effort, and the savings which come from quickly made methods changes, although not to be overlooked, are of secondary importance

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Type C studies have been widely used in the past, particularly where little emphasis has been placed on motion study. They give decidedly worthwhile results, although they can not be expected to accomplish as much as more detailed studies.

### Time Formula Applications

When many time allowances or piece rates must be established for a given class of work, time formulas can often be used to good advantage to simplify the work of the methods engineer. They permit him to establish a large number of accurate values without the necessity of taking detailed time studies.

It is sometimes thought that because no actual time studies are taken, the methods engineer is merely doing a form of estimating when he applies a time formula. This is not the case. Time formulas are based upon time study data and consist of these data arranged in a form which is convenient for quick interpretation and use.

When the conditions surrounding a given class of work are such that the derivation of a time formula is desirable, the methods which are being employed should be surveyed. If methods are good as the result of previous study of individual jobs, it will be advisable to proceed with the derivation of the formula at once. If not, as in the case of a line of work which has always been on day work, working methods must first be carefully studied. If it is advisable to study methods at all, it is usually worthwhile to go into rather great detail. Any improvements which are made will apply to many or all jobs handled, and hence savings in the aggregate are likely to be large.

The type D methods study is the time formula derivation procedure, preceded by detailed motion study, and it is likely to show greater results than the type E study on all but the most standardized lines of work. Hence it may be profitably employed in spite of the fact that its application may require a fairly long period of time, usually from two to six months.

The type F study is in reality no methods study at all but rather the quick application of some form of standard data for the purpose of setting a time or money allowance on a non-repetitive job. The standard data may be of almost any type. They may consist of written data compiled from stop watch time studies, a file of previously established allowances used for comparison purposes, or comparatively unorganized mental data acquired by experience and used as a basis for estimating.

The application of standard data is quick but the results obtained are not likely to be satisfactory. Allowances established from inadequate data are usually inaccurate, and difficulties are experienced in applying them which are avoided where allowances are established accurately. The reason that this type of study is mentioned at all is that it is quick and hence may have an application on jobbing work where quantities are unusually small. Because any sort of standard data is quickly and easily applied, it is sometimes used even though another type of study would be much more profitable. Thus in small plants and in some that are not so small, the estimator with his estimated allowances is still found, simply because it appears easier to continue with this procedure than to make the necessary effort to understand and introduce the more exact and more profitable procedures.

Even on jobbing work, it is doubtful if the type F study is often justified. An example has already been given of type E studies applied to tool room work. (See Methods Engi-

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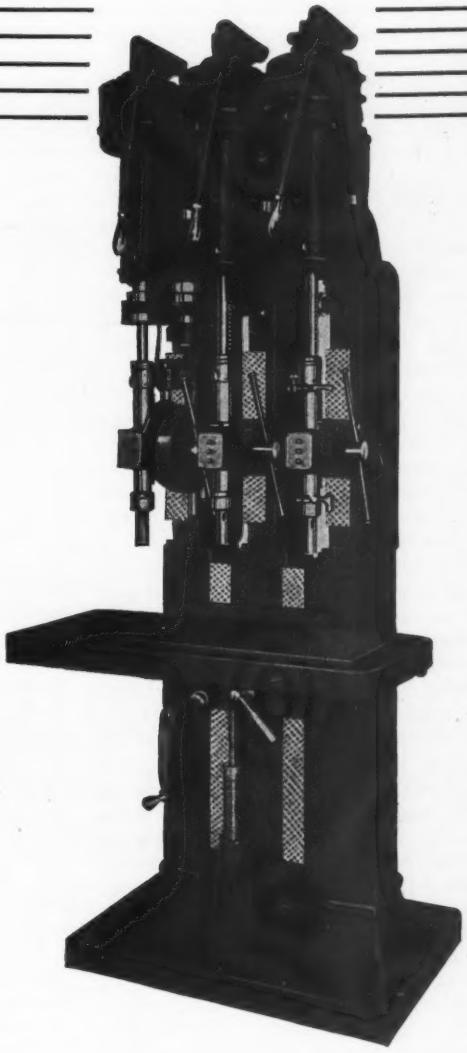

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neering Procedure: Incentives in the Tool Room—Modern Machine Shop, April 1936). Here of course, quantities are comparable with job shop quantities. In another case, the average quantity per job was three pieces. After several years of attempting to use type F studies with increasingly unsatisfactory results, time formulas of the type E were introduced. As a result, accurate allowances were established in the same or less time as before, the working force was better satisfied, and costs were lowered due to the elimination of unnecessarily high time allowances.

If the full time of but one man is occupied on a given class of work, the type E study will usually prove profitable, even though the lot sizes are very small. Hence, the field of the type F study is limited to small quantity part-time operations.

The kind and amount of study which is economically justified on any job or class of work is determined by three principle factors, namely, the repetitiveness of the job, the labor content, and the expected life of the job. All of these factors must be considered together, for no one of them in itself is sufficient.

For example, tacks are made in large quantities, and therefore tack making may be said to be a highly repetitive job. The type A methods study would not be justified, however, for the labor content is low. Tacks are made by automatic machines, and the only labor involved is that of an operator who watches a battery of machines to make sure that everything is going properly. His motions are non-repetitive, and a detailed motion study would be pointless.

Electric clocks are also made in large quantities. On this work, the assembly operations all require manual labor. Therefore on the assembly, at least, if the design is standard, a type A study would be justified.

Large steam turbines are made to customer's order. Operating conditions are such that each turbine is made to a special design. Most of the operations are non-repetitive, and therefore a type C or a type E study would be indicated. Many of the blades used within the turbine are standard, however. Each turbine takes a number of the same kind of blades, and these blades are common to a number of different turbines. Hence, the operations connected with manufacturing and assembling the blades are repetitive and would justify more detailed study, either type A or type B, depending upon the exact conditions.

A plant engaged in the production of novelty articles manufactures in large quantities. The labor content of the operations is high, but because the product is strictly a novelty, the life of the job is short. Here the problem is one of getting the method developed quickly and then training a number of operators to follow it, so that the product may be turned out in large quantities while it is in demand. Time does not permit the development of refined methods and careful operator training. If the product is to be made at all, it must be made immediately. Hence, type B or type C studies are indicated. Seasonal industries face the same problem, although if the operations remain the same from year to year, detailed study will be justified.

Castings in a jobbing foundry vary considerably in their characteristics but many of the operations performed in making them are the same. For a given size of flask the operations of placing cope and drag, filling them with sand and ramming, applying parting sand, and so on are the same. If a number of men are engaged on this work, the type D study will be justified.

**(This article will be continued in August issue)**

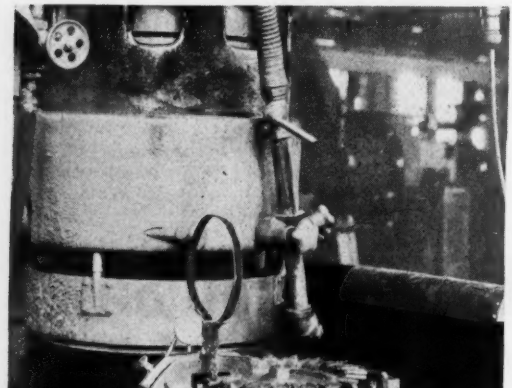
# Ideas from Readers

This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . Each one published will be paid for.

## Grinding Pivots for Scale Beams

By Francis A. Westbrook

PIVOTS for the lever arms of Fairbanks scales are finished by grinding in the fixture shown in the illustration set up on a Blanchard surface grinder. This job is in operation in the plant of the Fairbanks Scale Works at St. Johnsbury, Vt.



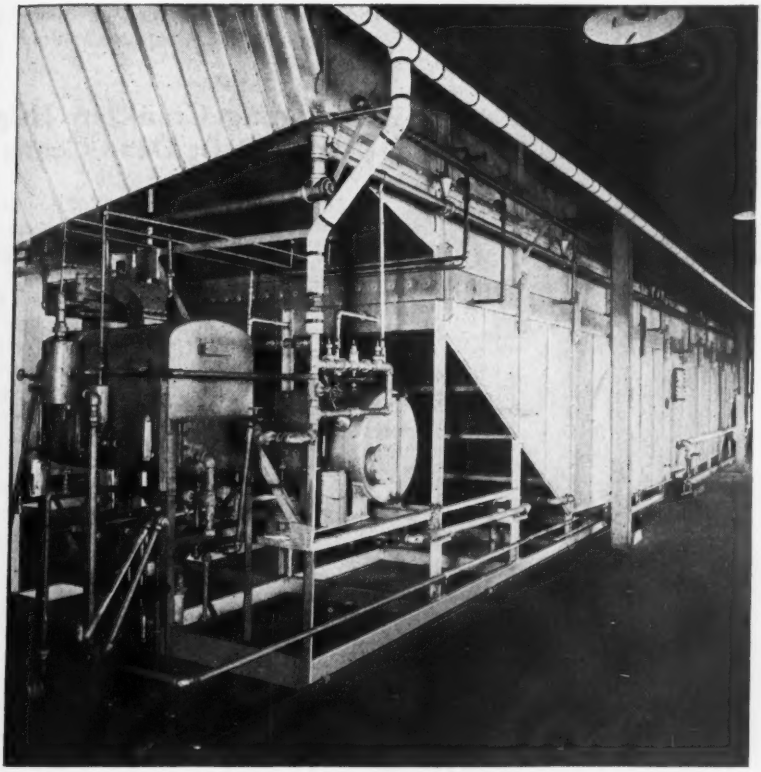
**Equipment for grinding pivots for Fairbanks scale beams.**

The operation of grinding the faces of these pivots is one involving considerable accuracy as it is necessary that the bisector of the angle form the knife edge of the pivot at right angles to the base, otherwise the scales will not be accurate.

A pivot is shaped somewhat on the order of a cam, as shown at A in the drawing. It is made of open hearth steel, and after being roughed to shape, is finished within close limits by grinding, first on one face and then on the other. The fixture holds 12 pieces.

The workpieces are held in a circular plate which is revolved in an anti-clockwise direction by means of a motor, indicated at G in the drawing, which applies power through a series of worm gears. The pivots are shown at A, in position in the fixture F. After the fixture is loaded, the indicator is set so that an equal amount of stock will be ground each side of the pivots. A hammer B, which is an integral part of the fixture, drives the pivots into place and anchors them for the grinding operation.

After the pivots have been passed under the grinding wheel by the pivot plate, they come into contact with the releasing cam D which releases each pivot so that it can be reversed by the loop turnover dog E. While still



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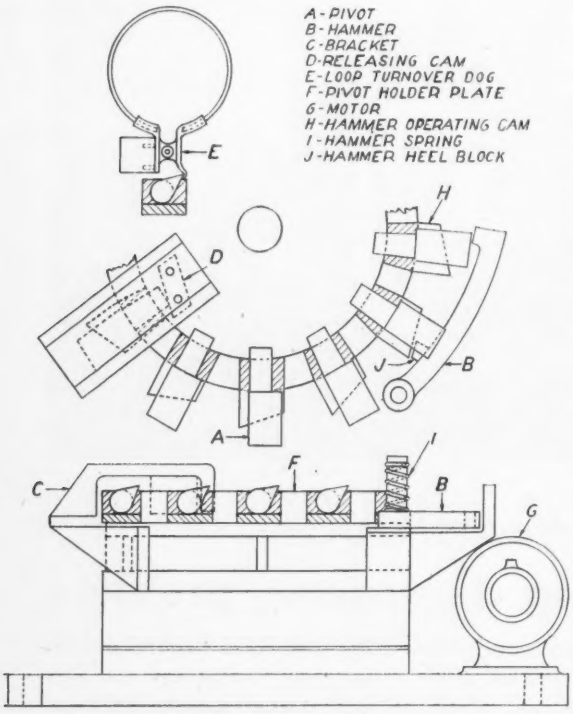
revolving, the hammer operating cam H contacts with the heel block J, attached to the hammer B. This block drives the hammer out, and as soon as the hammer operating cam H leaves the heel block J, the resistance of the spring I causes the hammer to strike a sharp blow on each pivot in turn, again driving each pivot into position for grinding.

Pivots for different sizes and types of scales are ground in this manner,




**Drawing illustrating design of fixture for grinding scale beam pivots.**

plates being available for each size. This arrangement has proved very economical over the method formerly employed, the production with this equipment being from 60 to 100 finished pieces per hour, depending upon the size. The cost on the operation has been reduced approximately 50 per cent.

## Oscillating Crankpin Helps Crank Past Dead Center

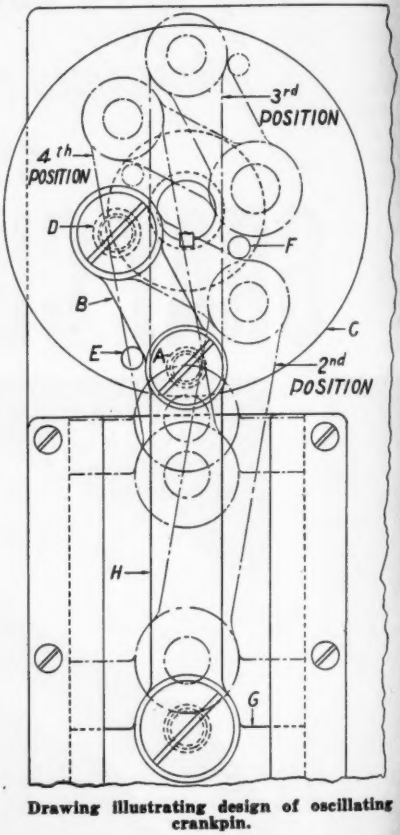
By J. E. Fenno

IN transmitting a rotary movement to a shaft from a reciprocating member moving in a straight line, the crank of ordinary design is inadequate unless a flywheel is used, due to the possibility of stalling on either one of the two dead center positions. The use of a flywheel is not always desirable, however, since it cannot prevent the crankpin from stopping on dead center when the power is finally shut off. When this happens, restarting is impossible without manual adjustment.

The drawing herewith shows the design of a crank with which a rotary movement can be imparted to the crank without the use of a flywheel, and which makes it impossible for the crank to stall on a dead center position. This unusual drive was designed for operating a nail hopper on a box-nailing machine.

The crank arrangement is similar to the ordinary design with the exception that the crankpin, indicated at A, is mounted on a lever B pivoted to the crank disk C at the point D. The oscillating movement of this lever is limited by pins E and F in the disk.

In the position shown in full lines, the slide G, connecting the rod H and crankpin A, are at the bottom of their stroke and consequently the crankpin is on dead center position. As the slide begins to move upward,




**Drawing illustrating design of oscillating crankpin.**

however, the crank disk does not rotate immediately; instead, the connecting rod swings the lever B up against the pin F (position 2) and, in doing so, the crankpin is carried past dead center position.

As the slide continues its upward movement, the connecting rod rotates the crank disk half a revolution, to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Lou Meyer

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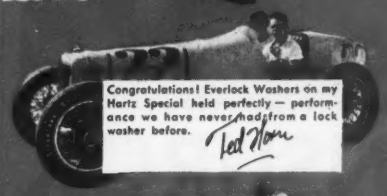
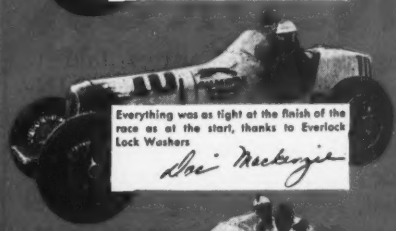


Congratulations! Everlock Washers on my Hartz Special held perfectly — performance we have never had from a lock washer before.

Ted Horn



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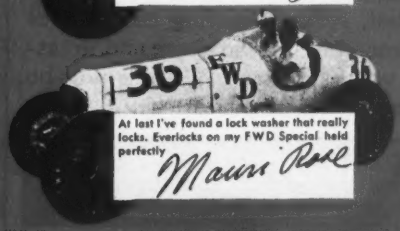


At last I've found a lock washer that really locks. Everlocks on my FWD Special held perfectly

Mauri Rose

# Everlock
## The Dual Action LOCK WASHER

position 3. It will be observed that during this half revolution the lever **B** has again come into contact with pin **E**. In position 3 the slide has reached the top of its stroke. As it returns, the crankpin **A** is swung past its dead center position and against pin **F** (see position 4) without rotating the crank disk.

As the slide continues downward to the end of its stroke, the disk is rotated the remaining half of the revolution so that the slide, connecting rod, and lever are in the position indicated by the full lines. As before, during this half of the revolution, the lever **B** returns against pin **E**.

In using this design, it is found that a slight dwell is obtained at each end of the stroke. However, this dwell is not objectionable for the purpose for which the mechanism is used.

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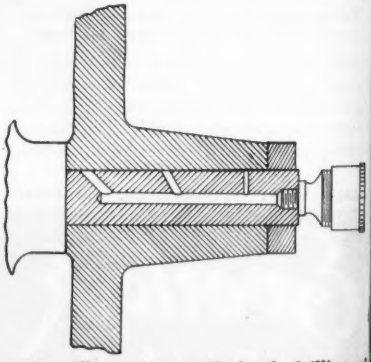
## Overcoming a Lubrication Problem

By L. Kasper

A LARGE gear, used as an idler in a train, was a source of trouble due to failure of the lubricant to



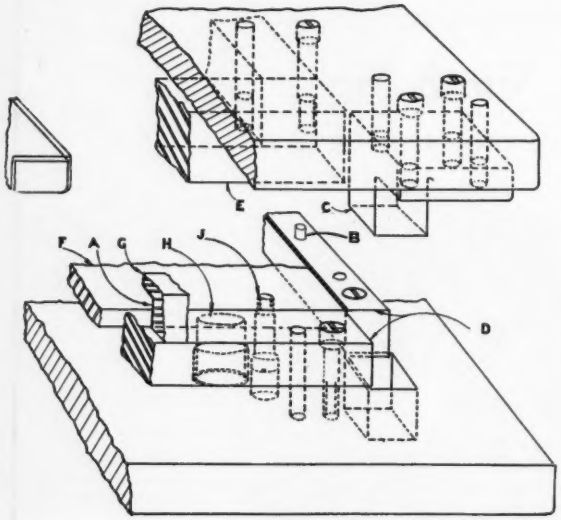
**Drawing illustrating method of drilling oil holes to assure even distribution of lubricant**

reach the inner end of the bearing. The lubricant was fed to the bearing through an axial hole in the end of

the shaft and thence through three radial holes to the surface of the bearing.

A slight change in the sizes of the radial holes, as shown in the drawing, overcame the difficulty. The holes were drilled to increasingly larger diameters toward the inner end of the bearing, and were also drilled at different angles, increasing the inclination toward the inner end.

The tendency of lubricant or any other liquid is to follow the path offering the least resistance. The object in placing the holes as shown is to equalize, as far as possible, the resistance to the flow of lubricant.




**Die for notching corners and forming sides of rectangular sheet in a single-action press.**

## A Complicated Job in a Single-Action Press

By David W. Mills

THE drawing illustrates the design of a die that was made to notch the corners and flange up the sides of a piece made from rectangular sheet steel, the tools being designed for use in a single-action press. To simplify the description, only one corner of the die is shown.

The size of the die is limited only by the capacity of the press. The work is fed by hand between the guide-strips A—of which there is one on each side of the die—and is stopped by the pin B. As the punch descends, the notchers C—of which there are four — cut square notches from the four corners of the work. The cutting edges for this notching cut are the ends of the forming blocks D. To many die designers this method of procedure will seem wrong because of the rounded inside upper edges of the forming blocks, but, actually, the cut is clean and examination of the work discloses no defect.

As the ram continues to descend, the forming punch rails E carry the work down and the four sides are folded to a 90-degree angle by the punch rails D. The pressure pad F, which may be either a solid plate or a built-up hollow rectangle, pushes the work out of the die, the work being stripped from the punch by the lip G which is integral with the guide strips A.

The part H is a cylindrical section of rubber, of which as many are used as may be necessary to push the work out. The screw-studs J are used to restrict the travel of the pressure-pad to the proper height. If the lips G are fitted carefully to the punch rails

E, and a similar rail is used on the end instead of the stop-pin B, the die can be made without guide-posts.

---

**WHITNEY OPEN MESH CONVEYOR CHAIN BULLETIN V-121.** This four-page bulletin outlines the use of Whitney Open Mesh Conveyor Chains for conveying from the molding machine to the annealing oven in the glass manufacturing industry. For this application the chain offers a maximum of smooth flat conveying surface, consistent with the need for an open mesh, which will allow free flow of a cooling blast through the chain.

Whitney Open Mesh Conveyor Chains can also be used in many cases where a flat metallic belt conveying medium is required. Chains in these series can be made entirely of steel, steel with bronze center links, or stainless steel according to the needs of the application. The construction of the chain is such as to provide a balanced design in any width with ample strength and bearing area. The unit link and bushing construction insures proper link spacing and with the hardened floating pin gives resistance to wear and chain elongation.

Copy free upon application to The Whitney Chain & Mfg. Co., Hartford, Conn.

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**INDUSTRIAL DUST CONTROL.** To fill a most important niche in the industrial executive's library comes a new book published by the Pangborn Corporation of Hagerstown, Maryland on "Industrial Dust Control Through Exhaust Systems."

Expertly written by W. O. Vedder, the book charts the progress made by various types of dust collecting systems to the present time, and outlines in easy to understand style the many advantages that modern dust control is bringing to industry today.

A few of the many subjects thoroughly discussed by Mr. Vedder include chapters on Exhaust Hoods and Piping System; the Dust Collecting Equipment; Types of Collectors in General Use in the Industrial Field; the Exhauster and Drive; and the Operation and Maintenance of Exhaust Systems.

The supply is limited but while they last the Pangborn Corporation will send copies without charge or obligation to engineers and executives when requests are received upon company letterheads.

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Small wonder that light has become the most important of all modern production tools. It is the one item that directly controls the relative effectiveness of every other tool in the shop. It is a factor in the cost equation which has often been responsible for worthwhile profits.

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For complete information write to the General Electric Vapor Lamp Company, 897 Adams Street, Hoboken, New Jersey.

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**COOPER-HEWITT MERCURY VAPOR LIGHT**

# *Over the Editor's Desk*

## *Safety and Gambling*

THE connection between horse racing and plant safety may seem far-fetched, but we recently have seen some data which it seems to us should be of interest to some of our readers.

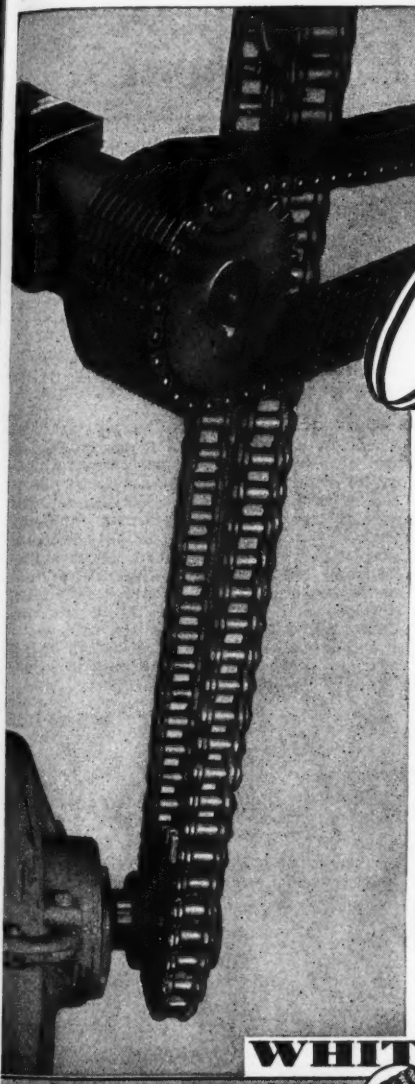
Known as the "Sports of Kings", horse racing is a magnificent sport for those to whom the loss of a wager is but an incident. When the person of average means starts betting on races, however, he is likely to become the victim of an obsession—an obsession of fear at the prospect of losing what to him is important money, or an obsession of anticipation at the prospect of spending his winnings. There is plenty of evidence that under such an obsession, the individual efficiency drops rapidly.

It came to the attention of employers in a certain area that, during certain periods of the year, production in the plants dropped off, the percentage of spoiled work increased, and the accident rate rose considerably. At first there seemed to be no reason for this situation, but an investigation developed the fact that these periods of low efficiency and high casualty were concurrent with periods in which horse races were taking place at a near-by park. Further investigation disclosed the fact that there had been wholesale withdrawals of savings from the local banks during these periods, all of which indicated that the horse races had a great deal to do with the conditions in the plants. It became evident that the loss in production and increase in accident rate was due to worry—worry over the prospect of losing savings which had been accumulated over perhaps a long period.

In one case the owners of the plant shut the plant down and moved it away because, as they stated, "Workers were so obsessed by gambling that they could not do a profitable day's work." The detrimental effect is so apparent on the days upon which important races are being run that in certain centers the advisability of closing down the plants on big racing days is being seriously considered. Notices posted to the effect that gambling employees would be discharged have only had the effect of increasing under-cover betting and more than ever demoralized the workers.

During the year 1935 race track wagers amounted to the sum of $6,600,000,000—a large part of which came out of the pockets of men of average income. The theory that this money is turned back into channels of trade is not borne out by facts. Assuming that $100,000,000 (a high estimate) was paid back in the form of winnings, some $6,500,000,000 was left in the hands of the bookmakers and race track promoters. The course of such money is hard to trace and these gentlemen are generally known to be opposed to parting with any more of this cash in the form of income taxes than is absolutely necessary. Consequently a large part of it finds its way into safety deposit boxes and other places of concealment.

Our object in presenting this matter is not to discuss the moral aspect of the situation—we are not concerned with that—but we are concerned with production, organization morale, and plant safety in general. This information is passed on for what it may be worth.



# Modernize with power saving Chain Drives

Chain Drives offer definite savings in power costs on plant or equipment applications. They give increased machine capacity through the maintenance of constant speeds and the positive transmission of power. They give capacity for unusual overload demands with long life and freedom from excessive maintenance costs.

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# New Shop Equipment

## Fellows Red Liner for Checking Hourglass Steering Worms

The Fellows Gear Shaper Company, Springfield, Vt., has recently placed on the market a new type of Red Liner for checking hourglass steering worms. It indicates the amount of clearance between the worm and sector or roller with index lines for each quarter revolution of the worm. This machine operates on the same fundamental principles as the regular Red Liner used for checking external and internal gears, with the exception that it is intended for hand operation only, and it is arranged with a 40 to 1 magnification for English and 50 to 1 for metric measure.

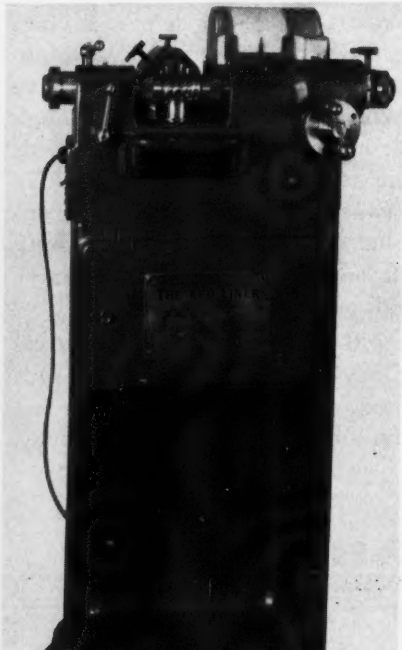


Fig. 1 shows a front view of this machine, whereas Fig. 2 shows a close view of the hourglass worm being checked and the master roller employed. The sector or master roller carrier is centralized with the worm by means of a ball point plunger, held in the carrier and brought in contact with both sides of the worm thread. This sets the carrier in the correct position for both angle and center distance. A light bulb in the cabinet is provided for illumination to facilitate making this setting and to inspect the location of contact of worm and sector teeth or roller.

Two size blocks are employed: one, which is shown in this illustration, sets the carrier at the correct angle; whereas, another size block, not shown, located at the rear of the machine sets the carrier at the correct center distance. Fig. 3 is a chart made on this machine and indicates the amount of clearance between the worm and the master roller or sector for each quarter revolution of the worm. It will be noted that the clearance between the worm and sector increases rapidly after the worm makes one complete revolution. This is to ob-

**Fig. 1—(Left) Front view of Fellows Red Liner designed exclusively for checking hour-glass steering worms.**

**Fig. 2—(Below) Close view of Fellows Red Liner showing worm and master roller in contact.**

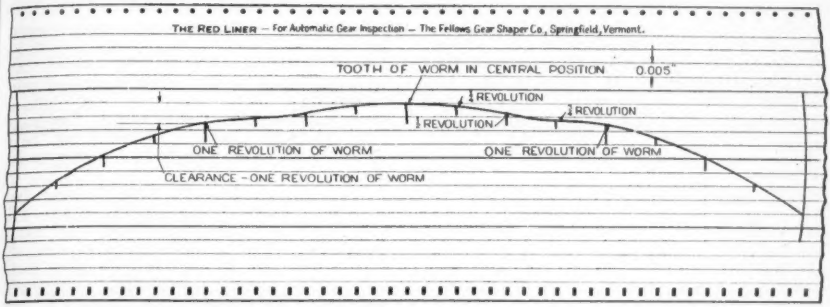



**Fig. 3. Representative Red Line Chart made on Fellows Red Liner for checking hourglass steering worms.**

viate any possibility of the roller or sector binding or cramping in the worm at the extreme ends.

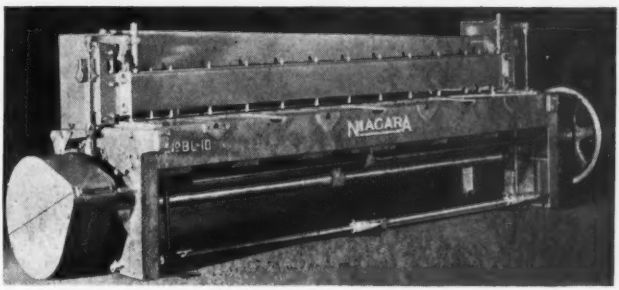
In operation the sector or roller holder is set to the correct center distance and angular position by size blocks, as previously explained, and when a master sector is employed the graduated dial on the operating handle is set at zero. If a master roller, however, is employed, then the graduated dial is rotated 180 degrees.

In checking a worm, it is necessary to start either at one end of the worm or the other, depending upon the direction of the helix. The sector holder carrying the master roller or sector is elevated and moved to the end of the worm, then lowered to engage the worm, and the crank handle on the graduated dial rotated in a clockwise direction until the roller reaches the opposite end of the worm. With a 40 to 1 magnification, the distance between the lines on the chart in Fig. 3 represents 0.005 inch. For metric measure with a 50 to 1 magnification, this distance represents approximately one millimeter. Maximum capacity is 3 inches pitch diameter.

## Niagara Series BL Power Squaring Shears

Niagara Machine and Tool Works, 637-697 Northland Ave., Buffalo, N. Y., announce a new line of Series "BL" Power Squaring Shears with capacities of 10-12 gage, built in 8, 10 and 12-foot cutting lengths. Rigid construction, accurate flat shearing, safety and convenient operation are features of the modern design of these new Series "BL" Shears.

Series "BL" Shears are of underdrive design. Crosshead is operated by connecting rods running direct from the eccentrics to the crosshead and thus relieving the housing of tension stresses. Heavy webbed beds are keyed and bolted to housings to assure and maintain positive alignment. Rear web of bed covers cross shaft thus protecting operator when removing sheared pieces at rear. Rigid triangular section steel crosshead resists torsional stresses in all directions and maintains alignment of knife. An adjustable truss rod provides support for center of knife.

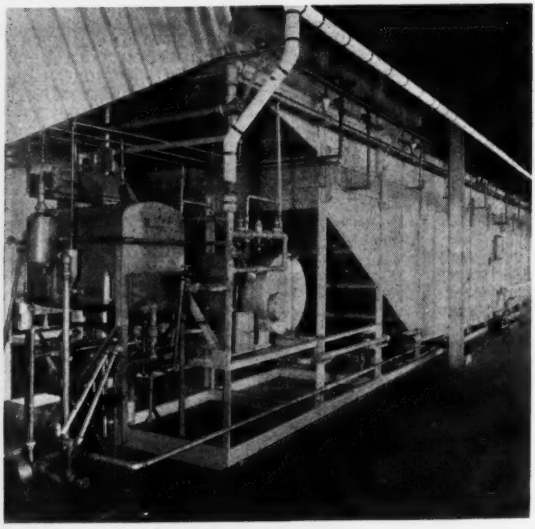



**Niagara Series BL Power Squaring Shear**

Sheets can be accurately cut to a line because the cutting line is clearly visible from the front of the shear between the pressure feet as well as from a position vertically above the cutting edge. The operator is enabled to view his cut with ease and without strain. Crosshead has a low slope which results in flat cutting of narrow strips.

Patented Niagara Holddown with indi-

vidual spring pressure feet provides a firm grip on short as well as long sheets. Pressure feet are adjustable so that they are not dependent on striking the bed to limit their travel when the shear is operating idly. Cam and toggle mechanism accelerates the holddown rapidly until it approaches the work, when it slows down, making a firm but soft engagement without severe impact. Cam and lever holddown mechanism eliminates transmission of stress to cams, mainshift or other moving parts during the cutting cycle. The entire operating mechanism is protected from the sheared pieces.



**Detrex Degreasing Machine**

## Detrex Degreasing Machine

The illustration shows what is said to be the largest degreasing machine in use in this country. The machine, a product of the Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich., is now a part of the equipment of the Dodge Division of the Chrysler Corporation. Fenders and sheet metal parts are degreased in this equipment before being bonderized. The parts to be cleaned are carried through the heavy vapor of chlorinated organic solvent which rapidly condenses on the metal surfaces and in flowing off, carries all oil and grease with it.

The Detrex Degreasing Machine is served by two Monorail Conveyors, each carrying a continuous stream of metal parts at a speed of approximately 20 ft. per minute through the vapor. All cleaning is automatic with a normal production of 17,000 lbs. per hour and a peak production of 60,000 lbs. per hour. The machine itself is 65 ft. 5 in. long, 10 ft. 5 in. wide, and 19 ft. 4 3/16 in. high.

The vapor line in this Detrex Degreaser stands about 8 ft. above the floor and is controlled by a cold water condenser that condenses all vapors above that point, the condensate flowing back into the boiling chambers. While the machine is operating, the solvent is kept at a boiling temperature by means of steam coils running along the bottom of the boiling chamber. In addition to the degreasing machine itself, a still is used to reclaim dirty solvent at a rate of 50 gal. per hour. The machine itself automatically distills 250 gal. of solvent per hour.

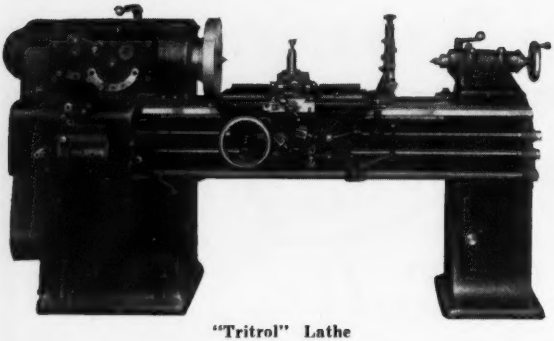
## Tritrol Lathe

The illustration shows one of the line of Tritrol lathes which have been placed on the market by the Sidney Machine Tool Company, 210 Highland Ave., Sidney, Ohio. These lathes are of the most modern design, built of the best materials obtainable, and to a high standard of protection.

One of the outstanding features of the Tritrol lathe is the use of Sykes continuous tooth herringbone gears in the headstock, providing the nearest approach to the complete elimination of gear tooth or tool marks in highly finished work. Speeds are obtained through 14 gears, all gears having 30 deg. helix angle. Speed changes are made through the operation of double-sided clutches which slide on multiple splined shafts having six integral keys to the shaft.

The herringbone gears used in the Tritrol headstock are of UMA No. 4 steel, which has a tensile strength, soft, of 150,000 lbs. per square in. The gears are heat treated, and all Tritrol headstock herringbone gear teeth are lapped under load.

The drive and all intermediate shafts are mounted on Timken precision roller bearings which fully compensate for radial and thrust loads, reducing fric-



"Tritrol" Lathe

tion loss to the minimum. The main spindle bearings are Timken tapered precision roller bearings, or one-piece tapered 80-10-10 phosphor bronze bearings, optional to purchaser.

The spindle adjustment is located on the outside of the headstock and spindle speeds are indicated by a direct reading index. Spindles are of high carbon hammered steel forgings. The headstock mechanism is lubricated automatically by a positive force feed system.

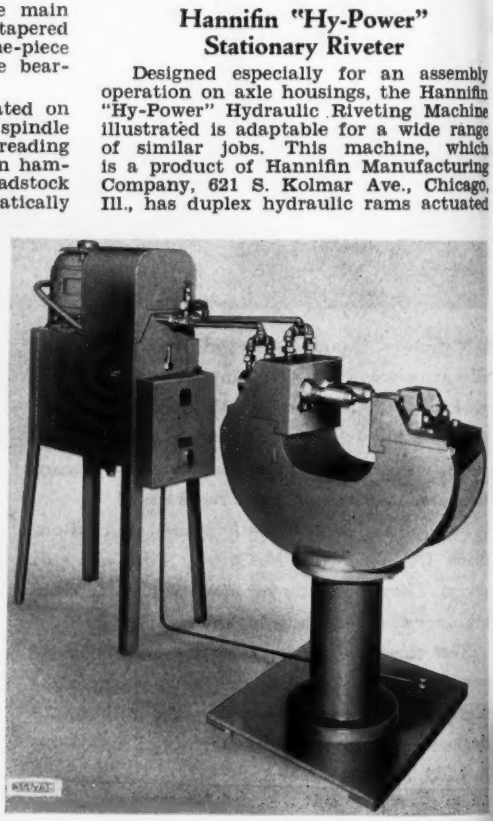
The lathe bed is of a mixture of 60 per cent steel, 1 per cent nickel gray iron presenting a close-grained, hard-wearing surface with a hardness of at least 190 Brinell. The leadscrew is of Cumberland 35-55 point carbon steel and is especially turned and ground. The machine is furnished with flat belt, multiple V belt or Morse silent chain drive. The motor is mounted in the cabinet leg under the headstock.

The automatic feed release can be adjusted for the use of tungsten carbide tools so as to kick out under the finest feed and protect the tool tip, or it can be adjusted to take a cut to the machine's capacity. The carriage on the Tritrol lathes is designed with an extra long bearing on the bed, the material being slightly softer than the bed, confining all wear to the carriage and permitting easy realignment to the lathe. The tailstock is of unusually heavy construction, with a long bearing on the shears for heavy duty work.

The lathe is made in two sizes: 14-in. and 16-in., the 14-in. lathe having a swing over the bed of 16¼ in. and the 16-in. lathe having a swing over the bed of 18½ in. Swing over the carriage is 10¾ in. and 13 in. respectively. Each lathe has 16 spindle speeds ranging from 14 to 562 r.p.m. The hole through the spindle is 1 9/16 in. There are 48 thread and feed changes, the range of threads per inch running from 1½ to 92. The range of feeds per revolution is 0.0027 in. to 0.172 inches.

## Hannifin "Hy-Power" Stationary Riveter

Designed especially for an assembly operation on axle housings, the Hannifin "Hy-Power" Hydraulic Riveting Machine illustrated is adaptable for a wide range of similar jobs. This machine, which is a product of Hannifin Manufacturing Company, 621 S. Kolmar Ave., Chicago, Ill., has duplex hydraulic rams actuated



Hannifin "Hy-Power" Stationary Riveter

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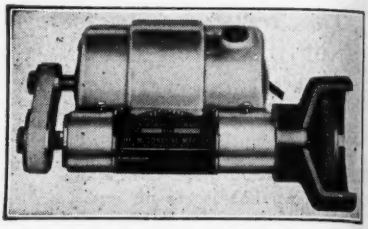
from a new type hydraulic pressure generator unit equipped with automatic electrically operated control valves. A special work-holding fixture makes handling extremely simple. The machine is controlled by means of a single foot switch button.

Touching the push button control actuates the hydraulic pump unit and automatic valves, the riveter cycle being completed automatically. The hydraulic ram cycle includes (1) rapid advance stroke at moderate pressure until the die touches the rivet, (2) automatic high pressure to head the rivet, (3) reversal at peak pressure, (4) rapid return stroke to starting position, and (5) oil pump idling at zero pressure between cycles.

The riveter ram develops 35,000 lbs. pressure, which is ample for heading ⅜-in. cold rivets. Equal pressure is applied to head both rivets, regardless of rivet length. The hydraulic pressure generator unit with automatic valves and control is driven by a 2 h.p. motor and occupies less than 4 square feet of floor space.

## Themac Type J-1 Precision Grinder

A portable electric grinder designed for use on small lathes has been brought out by The McGonegal Manufacturing Co., Rutherford, N. J. The Themac Grinder is designed for production jobs as well as for tool room precision grinding. The grinder is easily attached to the T-slot in compound rest and can be locked and operated in any position. The grinding spindle is circumferentially adjustable and the grinding wheel can be used on either the right or left side at either the front or rear of the motor. Large diameter external grinding is facilitated by the use of an extension arm.



**Themac Type J-1 Precision Grinder**

The Themac Grinder is equipped with a universal type motor which will operate on either direct or alternating cur-

rent. The motor can be supplied for either 110 to 120 volts, 25 to 60 cycles, or 240 to 250 volts. The motor armature is dynamically balanced and fitted with a fan. A baffle plate directs a constant flow of air across the armature eliminating the possibility of overheating. The motor and spindle housings are of aluminum. Selected precision ball bearings are used in the grinding spindle and motor, an automatic bearing adjustment taking care of expansion and contraction.

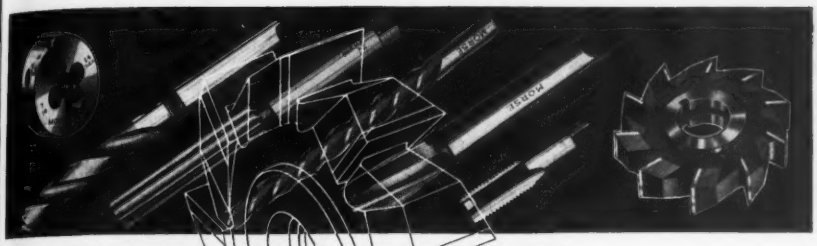
Pulleys are supplied which operate the spindle at from 7000 to 36,000 r.p.m. The pulleys are numbered and a table on the nameplate on the motor gives the correct combination to be used for wheels from 3-in. diameter down to ⅛-in. diameter. A set of wrenches, belt and external and internal grinding wheels are supplied as standard equipment. Mounted grinding wheels from ⅛-in. diameter to ⅜-in. diameter and unmounted wheels for use on the spindle up to 3-in. diameter can be supplied upon request.

## Sentry Model Y High Speed Steel Electric Hardening Furnace

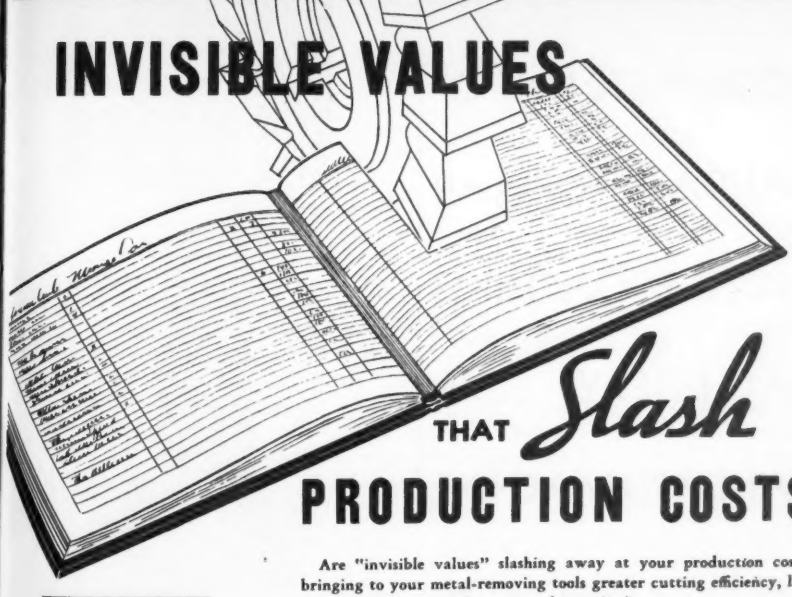
In order to make possible the production of small high speed tools of the highest quality, The Sentry Company, Foxboro, Mass., has developed a high speed steel hardening furnace especially designed for this work. The operating cost of the furnace is said to be very low and the furnace will produce the finest results on an economical basis whether used on a production or intermittent basis. The manufacturer states that when Sentry Diamond Blocks are used in conjunction with this furnace, the very finest hardening results possible will be obtained.

The furnace operates at temperatures up to 200 deg. F. Heating elements above and below the muffle assure uniform furnace temperatures. The normal life of the heating elements is 800 hours. A removable silicon carbide muffle chamber 4½ in. wide, 2 in. high, and 9 in. deep will accommodate sizes No. 1, 2 and 5 Sentry Diamond Blocks.

The furnace is of rugged construction with a steel shell suitably insulated for high temperature operation. When mounted on a pedestal, the hearth is 43½ in. above the floor. Terminals are adequately cooled by a reliable air cooling system. Terminals and all electrical contacts are shielded. With reasonably new heating elements, the furnace will heat from cold to 2350 deg. F. in consid-



# INVISIBLE VALUES



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Are "invisible values" slashing away at your production costs, bringing to your metal-removing tools greater cutting efficiency, less breakage, longer time between resharpening?

*They are if you use Morse Tools.* The "invisible values" are Morse Extra Values — hidden superiorities in every tool that bears the Morse trade mark. In putting them there, years of manufacturing experience play a part. So does carefully-controlled heat treating. Unusually accurate grinding. Step-by-step inspection.

Do you have doubts about a difference between leading brands of metal-removing tools? Then let Morse extra values prove themselves in your own shop. The Morse laboratory, with many years of tool engineering experience, will co-operate on any problem.

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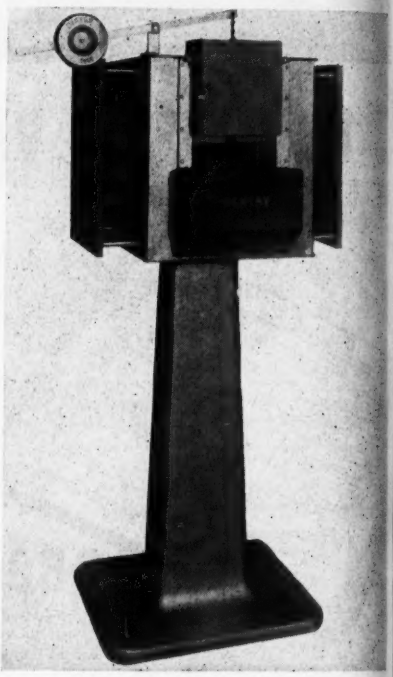
erably less than an hour. The normal operating consumption is 2¾ to 5½ K. W. Maximum rating is 10 K. W. The furnace will operate on 110 or 220 volts. Overall dimensions of the furnace proper, not including the door lever, are 24 in. wide, 22 in. deep, 25½ in. high. Shipping weight, 300 lbs. plus



**Sentry Model Y High Speed Steel Electric Hardening Furnace**

control. The furnace can be supplied with any standard control or connected to suitable control equipment.

## Grob Type S 14 Metal Band Saw

Grob Brothers, West Allis, Wis., have added to their line of die making machines a Type S 14 Metal Band Saw with brazing device for use in both external and internal sawing.

For internal sawing, any standard metal band from ⅛ in. to ½ in. wide is inserted into an opening large enough for the band to pass through. The band is then joined on the brazer which is conveniently mounted on the machine.


# Union Free Cut

(S. A. E. 1112)

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• Here is the Bessemer screw steel you have been looking for to speed up your production and reduce your cost of cutting tools.

Abrasive elements have been largely eliminated from Union Free Cut and that means longer life for tools, less tool grinding and less idle time for machines while worn tools are being ground. These advantages increase efficiency and develop profits.

In addition, Union Free Cut meets the highest requirements for quality. It machines rapidly to a lustrous, smooth surface. Threads and all other exacting details of parts are clean-cut and free from defects. Physical properties are equal to those usually associated with steel of the S. A. E. 1112 analysis.

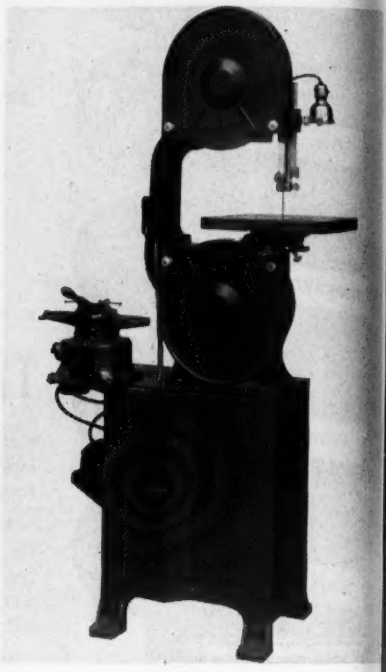
Don't say Bessemer screw stock—specify Union Free Cut. Distributors at all important centers carry this steel in standard shapes in a wide variety of sizes. They will fill your needs in a hurry.

PROMOTE EFFICIENCY WITH

# Union Cold Drawn Steels

A special grinder is furnished with the machine to grind the weld to proper thickness.

Three speeds are provided by means of a three-step pulley mounted on a floating motor and a V belt drive. Two V belt compound reduction drive pulleys are mounted on ball bearings directly to the frame of the base. Adjusting screws are so located that the V belts



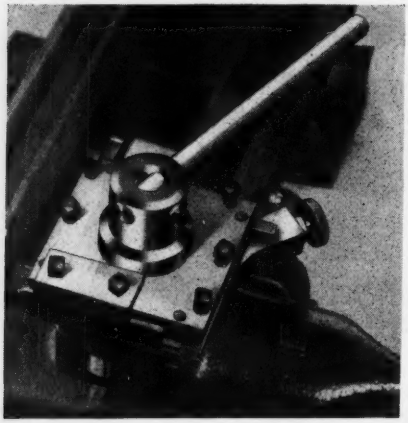
Grob Type S 14 Metal Band Saw

can be tightened from the outside of the machine.

The Type S 14 has a 14-in. throat. The size of the table 14 in. x 14 in. and the distance from floor to table is 45 in. total height, 60 in. Net weight, 30 pounds.

## Colwell Tool Post Turret

Plant executives who are familiar with the advantages of a turret tool post will appreciate the excellence of design of the Colwell Tool Post Turret shown in the illustration. This turret, produced of S. G. Colwell, 25 Congress Ave., Prov



Colwell Tool Post Turret

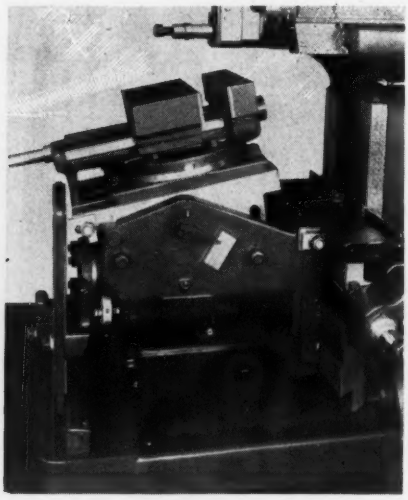
idence, R. I., is designed to carry four tools all of which are mounted directly in the turret. The turret can be clamped not only in the usual four positions, but can also be clamped between indexing positions if necessary.

The turret is made of high grade materials and to a high standard of workmanship.

## Ohio Universal Shaper Table

The illustration shows the Universal Shaper Table which is now being marketed by the Ohio Machine Tool Company, Kenton, Ohio. This table comprises an entire unit which will revolve a full 360 deg. on a trunnion, with a tilting top which is adjustable 15 deg. either way from horizontal on an axis at right angles to the trunnion. The unit is further equipped with a solid top, located 90 deg. from the tilting top.

The table is rotated by means of a self-locking worm and worm wheel on a very large trunnion cast solid with the apron. Accuracy in setting is facilitated by a graduated dial located at the front of the table. The table is furnished with a stop for a 90 deg. position, which brings the solid top under the ram. Both the solid and tilting tops have three T-slots. The tilting top is equipped with a graduated dial and pointer and a solid stop for locating in a horizontal position. The tilting movement is obtained through a self-locking worm and wheel. The saddle is equipped with a solid fit to the cross-rail, no flat gibs being used. Taper



Ohio Universal Shaper Table

gibs are provided in the top fit of the rail and on the dovetail fit at the bottom.

Tables can be supplied equipped with or without table support. The Ohio table support is equipped with an automatic compensating and equalizing jack located in the center of the support and automatically adjusted when locking the support. This construction assures perfect alignment of the table at all times after it is locked. The table support travels with the table, thus assuring rigidity and alignment at all times.

## Landis Collapsible Tap

The Landis Machine Company, Waynesboro, Pa., is now marketing a collapsible tap of interesting design involving the use of pilots to insure concentricity of the thread being tapped with other parts of the casting. The illustration shows such pilots applied to a Landis Style LT Collapsible Tap.

The body of the tap is of special length to reach to the bottom of a deep hole in a steel casting tractor part. The pilot ahead of the chasers lines up the tap with the bore of the hole which is to be tapped. The rear pilot is made in the form of a collar fitting over the tap body and fits a reamed hole near the top of the casting with which it is necessary


# New "H" BOND

## For Horizontal Surface Grinding

SB Borolon
VITRIFIED
SPECIAL ALUMINUM
OXIDE

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Here is your assurance of fast, cool surface grinding on *high carbon, high chrome steels* and other hardened tool room steels and special alloys without danger of burning expensive steel stock!

"H" Bond SB Borolon Vitrified Grinding Wheels permit very heavy cuts or feeds on the exceptionally hard tool room steels now becoming increasingly popular. Combined with exceptional wheel life, and requiring minimum dressing, "H" Bond wheels give truly outstanding grinding performance!

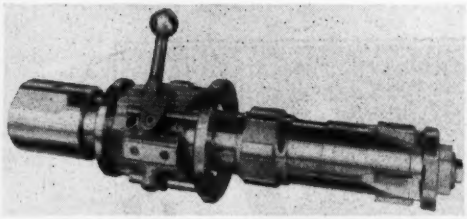
Insist on "H" Bond—easily identified by its "pink" color. Popular sizes include 7" x 1/2" x 1-1/4"; 8" x 1/2" x 1-1/2"; 10" x 3/4" x 2-1/2" and 12" x 1" x 1-3/8". Write for details.

* Write for your copy of new specialbulletinsabout ABRASIVE COMPANY "H" Bond and Tool and Cutter Grinding Wheels.

**ABRASIVE COMPANY**

Tacony and Fraley Streets
PHILADELPHIA, PA.

DIVISION OF SIMONDS SAW AND STEEL CO.



**Design of Landis Collapsible Tap Involving the Use of Pilots**

to maintain concentricity. Both pilots are made of steel, hardened and ground, and are constructed to revolve with the work in order to prevent seizing in the work.

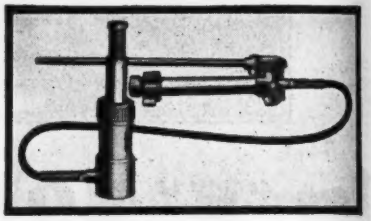
Similar pilot arrangements suitable for the requirements of practically any type of job can be furnished with the Landis Style LT Collapsible Taps in all sizes from 1⅜ in. to 12 inches.

## 20-Ton Porto-Power Unit

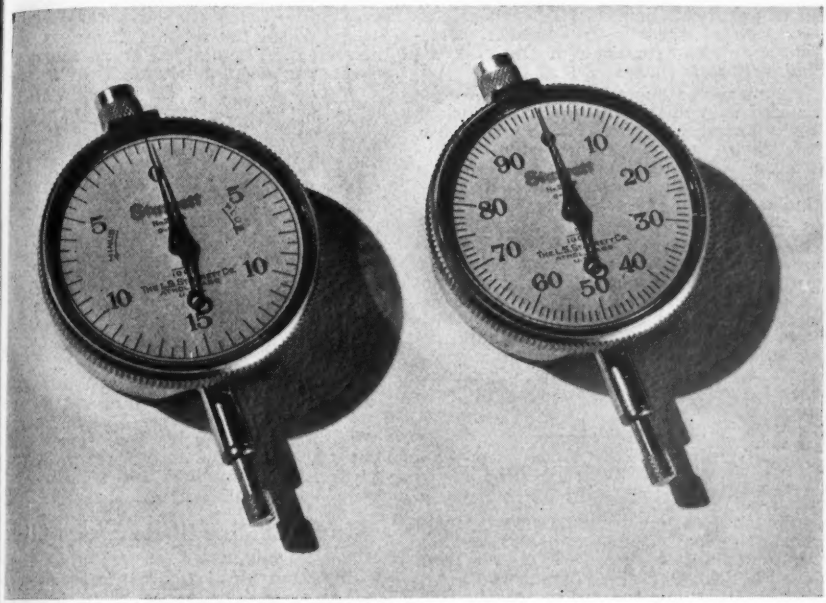
Development of a 20-ton capacity portable hydraulic jack for heavy duty work has been announced by the Blackhawk Mfg. Co., Milwaukee, Wis. The jack is a unit of the Porto-Power line, and consists of a pump and ram separated by a reinforced flexible hose.

Because of the remote control feature, the ram operates at full capacity in any direction, making it ideally adapted for vertical lifting or downward push in a press frame.

The pump of the jack may be mounted on a portable wheeled stand or can be carried directly to the job. The ram unit is connected to the pump by an 8-foot reinforced steel mesh hose. Collapsed, the height of the ram is 10¼ inches. The plunger travels 4½ inches while a screw extension of 3¾ inches



**20-Ton Porto-Power Unit**



# Made to STARRETT Standards

THE things you like most about Starrett Tools—their unfailing accuracy, their lasting dependability, their convenient design features — are all just as prominent in Starrett Dial Indicators. They bring the same speed and precision to gaging operations.

Starrett Dial Indicators are made in a complete range of standard sizes and dial arrangements, or special indicators can be developed to fit your particular problems. Jeweled movements, special cut and finished gears and pinions and stainless steel parts make them extremely accurate and durable.

The Special Starrett Dial Indicator Catalog MD illustrates and describes the entire line. We will gladly send it on request.

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**THE L. S. STARRETT CO.**
*World's Greatest Toolmakers*
*Manufacturers of Hacksaws Unexcelled*
*Steel Tapes—Standard for Accuracy*
**Athol, Mass., U. S. A.**

**Starrett Dial Indicators**

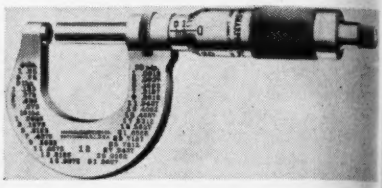
gives an overall height of 18 inches. The ram can be operated in crowded quarters, the overall diameter of the unit being only four inches.

The base of the ram unit is threaded to permit addition of heavy extensions or mounting in a press frame, converting the device into a convenient 20-ton hydraulic press. Extension may be attached to both the top and bottom of the ram.

Primarily designed for heavy duty work on frames, axles, chassis and automotive bodies, the unit also is adaptable for general shop work. By using the ram in a frame press small forcing and pressing jobs may be handled. Starting with the basic ram it is possible to build up combinations of attachments for any operation where hydraulic power is recommended in shaping metal by cold pressure.

## B & S Micrometer Calipers Nos. 12 and 13

The illustration presents a new design for Micrometer Calipers Nos. 12 and 13, products of the Brown & Sharpe Mfg. Co., Providence, R. I. These micrometer calipers combine the utility of the "C" type frame with the advantages of the design of the former Nos. 12 and 13. The narrow anvil end of the frame allows for measuring deep in slots. The "C" type



B & S Micrometer Caliper No. 12

frame permits convenient finger grip and full measuring capacity.

The No. 12 Micrometer Caliper has a range of 0 to 1 in. by thousandths, and the No. 13 Micrometer Caliper has a range of 0 to 1 in. by ten-thousandths. The scientifically designed frame is proportioned for strength and rigidity.

## Ingersoll Ray-Blade Face Mills

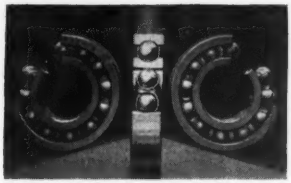
The Ingersoll Milling Machine Company, Rockford, Ill., has developed a cutter so designed that when roughing


## ...the basis of your saving

Forging the rings that later become raceways, from carefully selected bars of specially developed steel, is the foundation of the long, friction-free life which Fafnir Ball Bearings provide. The marked improvement in grain structure gained by this forging operation is just one of the hidden factors that contribute to the long-wearing, stress- and strain-proof performance that characterizes Fafnirs.

Such qualities pay greater and greater dividends as time goes on. Extreme accuracy and long life are direct results.

There is a Fafnir Ball Bearing that exactly fills every requirement. Backed by the most complete line of types and sizes in America, Fafnir engineers can always help you select the bearing best suited to *your* needs. . . . The Fafnir Bearing Company, *New Britain, Connecticut* . . . Atlanta . . . Chicago . . . Cleveland . . . Dallas . . . Detroit . . . Kansas City, Mo. . . . Milwaukee . . . Minneapolis . . . New York . . . Philadelphia.

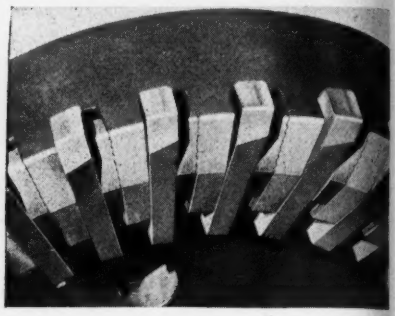


Forging is one of the 77 operations in the manufacture of a Fafnir Ball Bearing, of which this Single Row Bearing is a representative type.

# FAFNIR

BALL BEARINGS

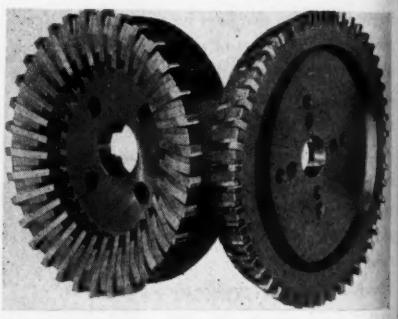
the wear on the cutter blade is mostly on the periphery of the cutter and when finishing, the wear is mostly on the face of the cutter. This cutter is equipped with a universal face milling cutter blade known as the Ingersoll Ray-Blade.



**Close view of Ingersoll Ray-Blade**

The blade is designed to lie along the radial face of roughing cutters or along the conical diameter of finishing cutters. It is radially adjusted to compensate for the diametrical wear in the roughing cutter and is axially adjusted in the finishing cutter to take care of the wear on the face of the blade. It is easily set to any desired dimension.

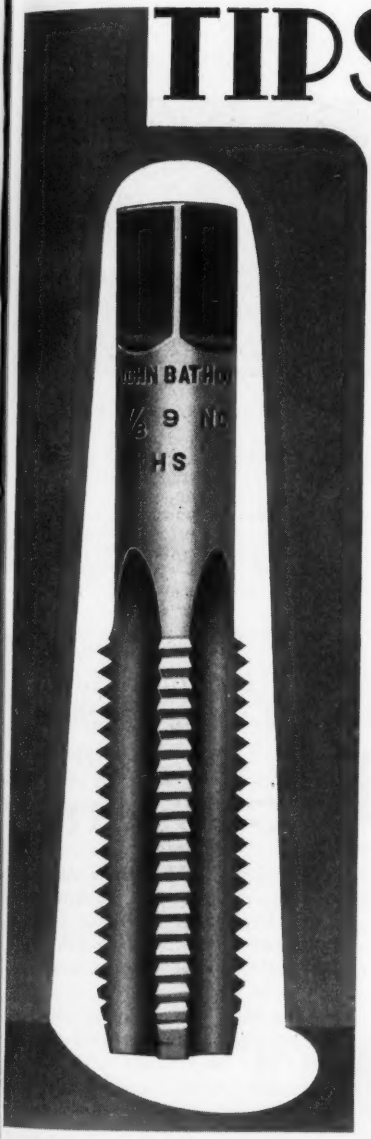
The Ingersoll Ray-Blade is a double



**(Left) Ingersoll Ray-Blade Roughing or General Purpose Face Mill**
**(Right) Ingersoll Ray-Blade Finishing Face Mill**

tapered blade, positively locked in the cutter housing with a compensating serrated wedge. A taper on the blade prevents it from being forced back by the thrust of the cut and a dovetail taper across the blade prevents it from being

# TIPS on TAPS




Every Bath Tap—large or small—coarse or fine pitch—is ground From The Solid **After** Hardening . . . assuring the user of uniform hardness in cutting teeth . . . maximum accuracy . . . and longer life.

Gone are all such old faults as soft, insufficiently hardened teeth, or brittle, burned teeth.

The exclusive Bath Process brings you taps with super finished teeth, highly polished flutes, lapped centers, file hard tops (perfect cutting edges that stand up well between grinds) and extreme accuracy.

**Call in a Bath engineer for recommendations on your tapping problems. No charge.**

**JOHN BATH & COMPANY, Inc.**
**WORCESTER, MASS.**

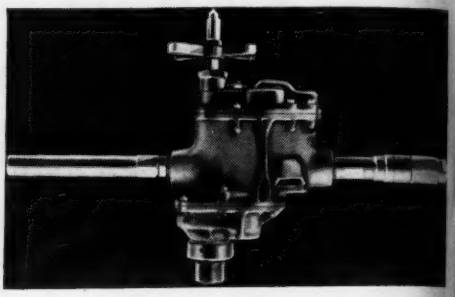
**SPECIFY BATH TAPS**

pulled out of its slot. The blade is securely retained in position by a double tapered serrated wedge. As the cutter blade is moved outward for regrinding, the wedge compensates for the thinning movement of the grinding operation.

The Ray-Blade Roughing Cutter is designed for light or medium cuts, ¼ in. deep or less. The finishing cutter is designed with closely spaced blades for fine finishing operations. The blades can be supplied in either high speed steel or stellite and the same Ray-Blade may be used in either right or left hand cutters. Standard Ingersoll Ray-Blade Cutters are made to suit the Ingersoll or National Standard Drive. Special cutters can be provided to fit any type of milling machine or horizontal boring mill.

29/32-in. drilling and 13/16-in. reaming and the E-73 for 1¼-in. drilling and 1-in. reaming.

The motor is of the rotary type, very

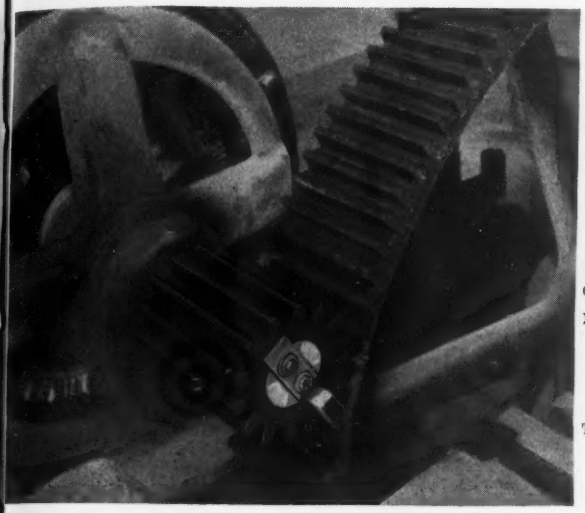


Rotor Model E-72 Non-Reversible Air Drill

## Rotor Model E-72 and E-73 Non-Reversible Air Drills

The Rotor Air Tool Co., 5600 Carnegie Ave., Cleveland, Ohio, has brought out a rotary type air drill which is being made in two models; the E-72 for up to

simple in operation and light in weight, weighing only 22 lbs. The manufacturer claims that the motor has more than ample reserve power to handle the heaviest work within the range of the tool. Maximum strength is provided by the use of spur gears with a heavy pitch tooth and a helical gear for the final



# Keep down the Noise with Formica Pinions

**Noise is sales resistance, where machines are concerned, and it is minimized in the machine that is driven with a Formica pinion, and uses Formica gears. Hence the growing popularity of Formica with the sales departments of machinery manufacturers.**

**The work of the maintenance man on machines is judged by the smoothness and quiet with which the equipment operates, and Formica gears, used to replace metal gears, will often greatly improve that condition.**

**The gear cutters named can give you prompt service on one or many Formica Gears.**

**THE FORMICA INSULATION CO.**
**4640 Spring Grove Ave., Cincinnati, O.**

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Chicago Rawhide Mfg. Co., Chicago, Ill.
Good Specialties, Inc.
Chicago, Ill.
Merkle-Korff Gear Co.
Chicago, Ill.
Chicago Gear Co.
Chicago, Ill.
Foote Gear Works
Cicero, Ill.
The Cincinnati Gear Co., Cincinnati, O.
The Horsburgh & Scott Co., Cleveland, O.
The Stahl Gear & Machine Co.
Cleveland, O.
The Adams Company
Dubuque, Ia.
The Ferguson Gear Co.
Gastonia, N. C.
Hartford Special Mchny. Co.
Hartford, Conn.
Beaty Machine Works
Keokuk, Ia.
Kansas City Welding Machine Works
Kansas City, Mo.
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Badger State Gear Co.
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Rodney Davis and Sons
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The Pittsburgh Machine & Supply Co., Pittsburgh, Pa.
Standard Gear Co.
Pittsburgh, Pa.
H. W. Honeymon & Son
Providence, R. I.
Perkins Machine & Gear Co.
Springfield, Mass.
Winfield H. Smith, Inc.
Springville, N. Y.
Alling Lander Company
Sodus, N. Y.
Arlington Machine Co.
St. Paul, Minn.
Farwell Mfg. Co.
Toledo, Ohio
Diefendorf Gear Corp.
Syracuse, N. Y.
Worcester Gear Works
Worcester, Mass.

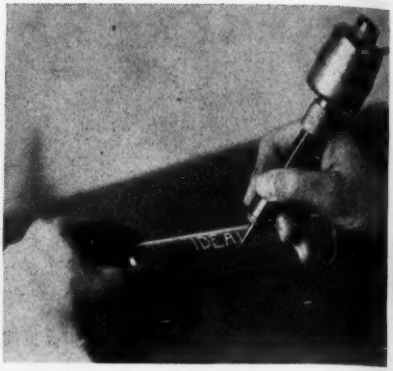
drive. The gear case and cylinder housing are of special heat treated aluminum and a malleable iron gear case can be furnished if desired. The cylinder liner is of special, hardened cast iron.

An interesting feature of the tool is the multi-port automatic governor which controls the speed, reducing the air consumption and preventing racing of the motor, and thus reducing drill or reamer breakage or burning.

## Ideal Electric Marker

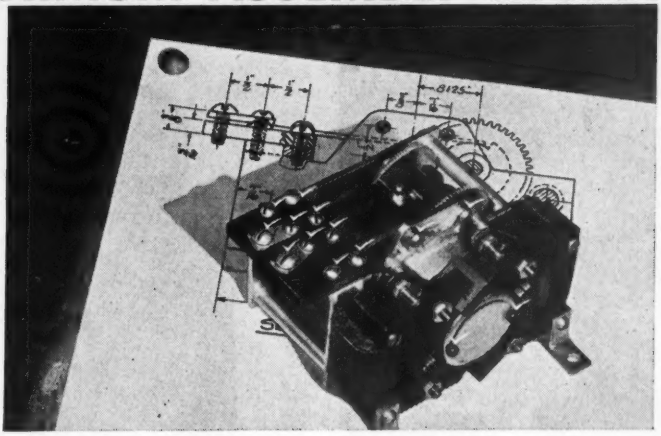
Ideal Commutator Dresser Co., 1445 Park Ave., Sycamore, Ill., has brought out an electric marker in the form of a portable electric tool which can be used for marking on practically any material, irrespective of whether it is a metal or a non-conductor of electricity. The marker is supplied with a special point suitable for marking all materials including hardened steel. In addition to metals, the Ideal Electric Marker will write on glass, pottery, hard rubber, Bakelite, fibre and similar materials, making a very clear and definite mark.

The unit writes like a pencil, is simple, compact, sturdy, light in weight and is said to be dependable in action. No auxiliary controls, rheostats or transformers are required for operation; the unit is ready for service by plugging into any 110 volt, 60 cycle, A.C. circuit. Standard equipment includes a 6-ft. extension cord, plug and switch. The unit can be furnished for 220 volt circuit if required. The marker is built for long wear and hard service.




**Ideal Electric Marker**

# How a Drawing can be made to guarantee MAXIMUM ASSEMBLY ECONOMY



When the drawing of this Timer left the board it carried with it a positive assurance of a saving of 25 percent of fastening time and labor. The designers were able to guarantee maximum economy in assembly. Instead of designating one of several optional methods of making the fastenings required, they carefully weighed one against another. They sought *the one best method,* considering economy and security. It proved to be Parker-Kalon Hardened Self-tapping Screws.

A careful comparison of fastening methods, including these unique Screws, at the drawing board has proved to be decidedly profitable in hundreds of plants. In 7 out of 10 cases where metal or plastic assembly is involved a thorough and unbiased comparison indicates that Hardened Self-tapping Screws will do the job better, in less time, for less money. Often, they also make design simplification possible.

### *Use This Specialized Knowledge in your study of fastening methods*

When your product is still in the blueprint stage ask to have one of the Parker-Kalon Assembly Engineers call and go over the fastening problems with you. With a background of practical assembly work he can render intelligent assistance. And he has a specialized knowledge of Hardened Self-tapping Screws enabling him to recognize the many different types of assemblies which these Screws WILL make better at lower cost. His help will insure you against missing any opportunities for economy which Hardened Self-tapping Screws could effect. We will be glad to schedule a visit at your plant if you will write us.

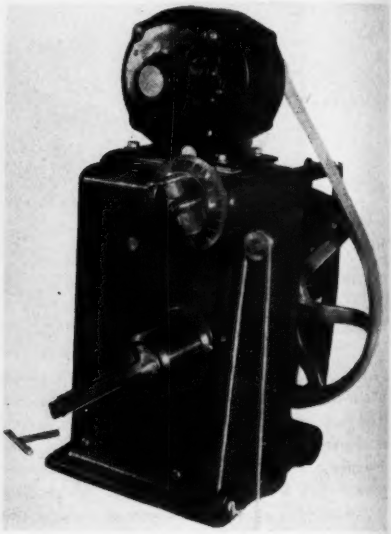
PARKER-KALON CORPORATION
Dept. M, 198 Varick Street New York, N. Y.

**PARKER-KALON *Modern* FASTENING DEVICES**

A HARDENED SELF-TAPPING SCREW FOR EVERY KIND OF ASSEMBLY

## Sunnen Precision Honing Machine

Sunnen Products Co., 7900 Manchester Ave., St. Louis, Mo., has brought out the precision honing machine shown in the illustration. This machine is designed to grind and finish any hole from 0.480 in. to 2.400 in. diameter and up to 7 in. in length. Accuracy within 0.0001 in. is guaranteed. The machine is intended for the honing of any metal except lead or babbitt, and will operate on any small hole that is not more than



**Sunnen Precision Honing Machine**

7 in. in length, where the work can be held in the hand.

Stock is removed rapidly by the use of this machine, from 0.012 in. to 0.015 in. per minute being removed in bronze, or from 0.004 to 0.006 in. per minute in aluminum or cast iron where the hole is not more than 2 in. long and 1 in. in diameter. This amount will increase or decrease as the hole varies in size or length. Hardened steel can be honed at a good rate of speed and to produce a high finish.

The cutting pressure is controlled through the foot pedal. Release of the stone in the mandrel is instantaneous and automatic, and when the pressure is released on the foot pedal, the stone withdraws automatically. Sizes are easily duplicated, a micrometer stop

being provided to prevent grinding oversize. Power is supplied by a GE ¼ h.p., 110 volt, 60 cycle A.C. motor.

## Williams "Superector" Reversible Ratchet Wrench

A line of heavy duty reversible ratchet wrenches, to be known as the "Superector", has been added to the products manufactured by J. H. Williams & Co.,

**Williams "Superector" Reversible Ratchet Wrench**

75 Spring St., New York, N. Y. Featured in the design of the wrenches are quadruple pawls, instead of the usual two, which provide double bearing strength with increased durability. The handles are drop-forged to utilize the extra strength afforded by the pawls.

Built for rapid operation in work requiring strong, fast-action tools, the Williams "Superector" is made in five sizes, from 24 in. to 48 in. Both hex and square sockets, with hole extending clear through, openings 1 1/16 to 4⅝ in., turn nuts on any length of bolt.

## "Aerisweld" Electrode for Welding Non-Ferrous Metals

Bronze, brass, or copper products can be fabricated or old ones reclaimed by the use of a phosphor bronze electrode developed by The Lincoln Electric Company, Dept. E-233, Cleveland, Ohio. "Aerisweld", as the new electrode is called, provides a solid homogeneous deposit having characteristics of true phosphor bronze with a notably high tensile strength and of a high quality.

Busbars, large contacts, impeller blades in pumps and turbines, ornamental bronze, bronze doors, and many types of bronzes which are considered exceedingly difficult to braze are readily welded with "Aerisweld". The electrode is also valuable for welding galvanized sheets where minimum disturbance of the galvanizing is essential.

"Aerisweld" is a shielded arc electrode for use with the metallic arc. Its coating, as it burns, produces a gas which shields the molten metal from harmful effects of the atmosphere and assists in easing the flow of molten metal in the

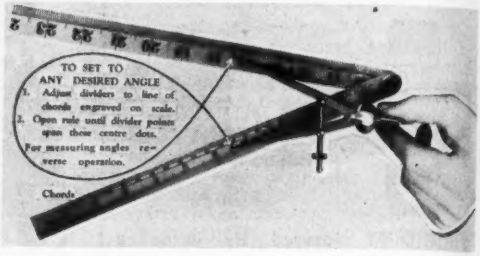
arc. In using "Aerisweld", welding current of positive polarity is employed on the electrode.

Preheating of the parts is unnecessary when welding any ferrous metal and the lighter grades of copper and bronze. Where heavy bronze or copper is to be welded, some preheating may be desirable due to the high heat conductivity of these metals. In such cases preheating is easily accomplished by using a carbon electrode with the negative polarity and rapidly moving the arc over the area to be welded. For cast iron, low current is used since excessive heat is detrimental to satisfactory welding of this metal.

"Aerisweld" electrode is made in two sizes: 5/32 and 3 16-in. dia. and 14-in. lengths, and comes packed in standard containers of 5 pounds net, each size.

## Chesterman Jointed Stainless Steel Rule

Layout work can be simplified and expedited by the use of the Chesterman Jointed Stainless Steel Rule, now being marketed by George Scherr Co., 130 Lafayette St., New York, N. Y. In addition to the usual graduations, the rule is provided with a line of chords engraved on one side of the rule from 0 deg.




Chesterman Jointed Stainless Steel Rule

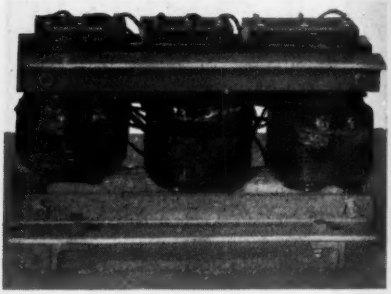
to 120 deg. advancing by half degrees, and the rule is also provided with two center dots by means of which, with the aid of a pair of dividers, the rule can be set at any desired angle, thus making it available as a protractor. The joint is provided with a spring tension which supplies sufficient friction to hold the angle setting rigid for scribing. Thus

any angle desired can be obtained without making any calculations whatever.

The rule is graduated in 1/8, 1/16, 1/32 and 1/64 in. The rule is 24 in. long, with a single joint as shown in the illustration.

## Forbes & Myers Three Phase Transformer

Forbes & Myers, 172 Union St., Worcester, Mass., have brought out a three-phase transformer especially designed for the demonstrator who may find that the current available for operation of his equipment varies at different points. By the use of this transformer his demonstrating machinery may be arranged for



**Forbes & Myers Three Phase Transformer**

any voltage he may select, and the transformer will produce this voltage from any of the more common commercial voltages.

Another common need for a transformer of this kind is occasional removal from one building to another. The small company that may move into larger quarters may find the new quarters equipped with current of a different kind, making it necessary to rewind all the motors or exchange them. A single transformer often makes the changes unnecessary.

The transformer is of the semi-portable type, can be easily handled, and quickly installed by placing on the floor or bolting to the wall or ceiling. The active parts are securely attached to steel angles and enclosed by a ventilated steel case (not shown) so that full protection is afforded against accidental contact with the live parts. Cooling is accomplished by natural circulation of air through the ventilating openings.

The transformer is regularly equipped with terminals for 220, 440 and 550

volts, three phase, 60 cycle. Where two phase or other voltages are desired they can be furnished. With this transformer 220 volt current can be changed to 440 and 550, 440 can be changed to 220 and 550, and 550 can be changed to 220 and 440 without any alteration in the transformer. Standard sizes are from 1 to 50 KVA, the largest size being sufficient for an ordinary installation of 50 h.p. in motors.

## Lyon 15-Ton Hydraulic Lift Truck

Originally built for transferring dies back and forth to and from large stamping presses, the 15-Ton Hydraulic Lift Truck shown in the illustration has now been made available to industry generally by the Lyon Iron Works, Greene, New York. The truck is believed to have the greatest capacity of any hand lift truck built. The carrying platform is 30 in. wide by 84 in. long. Lowered, the height is 9¼ in. and is 13 in. when elevated. The main frame and elevating frame are of heavy structural members electric arc welded.

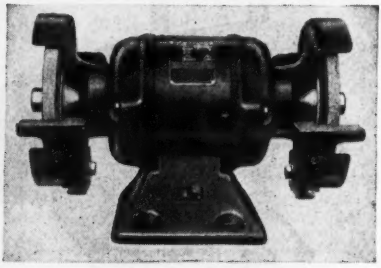
A handle is provided for pulling by hand and a towing hitch is also provided for towing behind a power unit.


**Lyon 15-Ton Hydraulic Lift Truck**

The elevating frame is raised by means of hydraulic rams operated by a hand hydraulic pump. The truck runs on four wide-face rear wheels and two front wheels, all with extra large ball-bearings. Manipulation of the truck is facilitated by large thrust and radial bearings in the fifth wheel steer.

## Thor BG66 6-In. Bench Grinder

A 6-in. bench grinder, particularly designed for general grinding, polishing, buffing and wire brush work, has been



Thor BG66 6-In. Bench Grinder

placed on the market by Independent Pneumatic Tool Co., 610 W. Jackson Blvd., Chicago, Ill. This grinder, known as the Thor Type BG66, is equipped with ball bearings throughout and has a completely enclosed motor, which eliminates operating difficulties due to oil and dust. The tool rests can be adjusted to various positions. Wheels are enclosed in heavy wheel guards for safety. The wheel size is 6 in., and the grinder can be furnished for either 110 or 200 volt current. Free speed is 3550 r.p.m. Weight, 35¼ lbs.

## Watervliet Spiral Expansion Self-Aligning Reamer

A spiral expansion self-aligning reamer especially designed for the reaming of motor shaft bushings has been brought out by the Watervliet Tool Co., Inc., Albany, N. Y. After the bushings have been pressed into place, a tapered floating collet is located in one bushing where it will perfectly center itself. This done, the reamer is entered into the opposite bushing so that the pilot will pass through the collet. The reaming operation is performed, then the reamer is withdrawn, the collet is placed in the reamed bushing, and the operation is repeated from the opposite side. This method insures that the bearings will be reamed in perfect alignment with each other.

The reamer is spiral fluted, thus it will cut smoothly and leave a full bearing surface with a mirror-like finish. The reamer is expanded by the use of

mentary position of the jaws. Due to this improved method of retaining the free-floating load cushions, larger hubs are possible and design likewise permits greater load carrying surfaces and increased load carrying capacity.

Load cushions are always in plain sight for inspection and can be removed and replaced in a few minutes when necessary. There are no metal to metal contacts and no wear on the iron or steel jaws. In operation, one-half of the cushions are idlers (except on reversing loads), hence there is always a set of new cushions in the coupling. Due to this feature costly and lengthy shut downs are eliminated as load cushions can be interchanged when machines are not in productive operation without tearing down coupling.

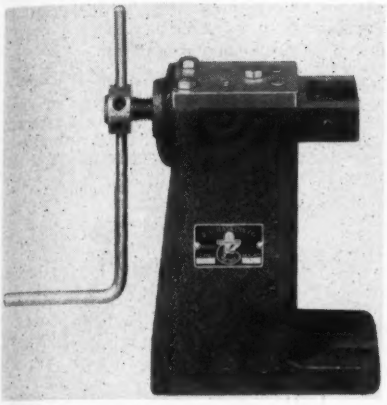
Three types of resilient cushioning materials are available: (1)—Metalflex; a high grade, long-wearing brake lining material, used for heavy shock loads as on excavating machinery, steel mill equipment and other machines exposed to extreme weather conditions. (2)—Leather Load Cushions; of best quality oak tanned belting leather, for use on sustained loads and greater misalignment. (3)—Multiflex Cushions; a rubber duck fabric, vulcanized under pressure, for use on fluctuating loads and where high resilience is required. L-R Type "W" Flexible Couplings are also furnished with one body made as a flange for bolting to the flywheel. This flange-body design reduces overall length of the coupling by one-third.

L-R Type "W" Flexible Couplings are made in standard sizes with bores from 3 in. to 14 in. (18 to 2000 h.p. at 100 r.p.m.) By application of suitable materials and design, capacities can be materially increased without change in overall dimensions.

## Haskins No. 602 Vise Fixture

To promote accuracy in high speed tapping and drilling, in order to meet the requirements of modern manufacturing, the R. G. Haskins Company, 4667 W. Fulton St., Chicago, Ill., has developed a fixture for use in these operations. This fixture ,known as the Hasking No. 602 Vise Fixture, is simple to operate, easy to use, and is said to be permanently accurate.

The three-point contact jaws are of hardened tool steel, five combinations of jaws for handling round stock from 3/16-in. to 1-in. being available. The handle can be adjusted to any position,



**Haskins No. 602 Vise Fixture**

it being necessary to move the handle only 30 deg. in order to release the workpiece. The base is provided with a T bolt and slot for mounting on the machine work table.

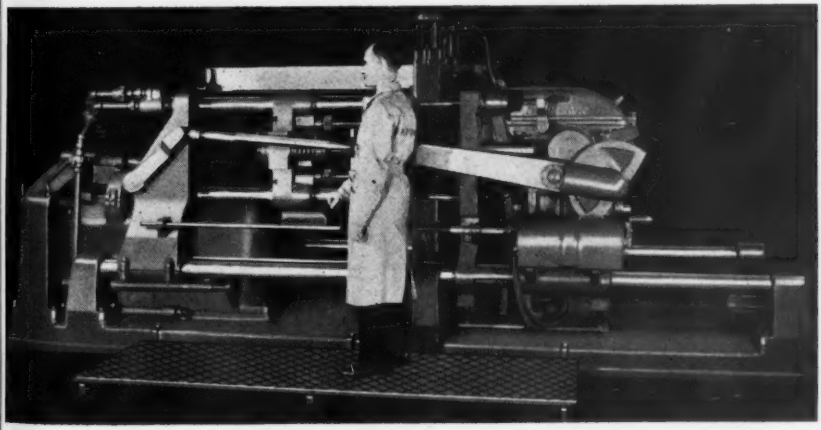
## Madison-Kipp No. 8 Automatic Die Casting Machine

The Madison-Kipp Corporation, Madison, Wis., has brought out an automatic die casting machine which operates on the same general principle as the No. 4 and No. 5 machines, but which is much larger, weighing 30,000 lbs. and having effective capacity for the direct air pressure gooseneck of 25 lbs. in zinc alloy. The size of the machine is 22½ x 28½ in. and the metal pot capacity is 1200 pounds.

The machine is driven by a 7½ h.p. multi-speed motor, first through a silent chain drive with a ratio of 4.86:1, then through a worm and worm wheel with a ratio of 74:1. The reciprocating action which opens and closes the dies and which automatically provides the proper dwell period for shooting the casting is accomplished through the patented dwell crank cam units which are also standard equipment on the smaller models of Madison-Kipp Die Casting Machines.

The No. 8 machine will handle alloys of zinc, aluminum, lead or tin. Inasmuch as the pressure areas are apt to be very great on large casting work, the crosshead of this machine is equipped with four air cylinders to which wedges are attached so that when the machine is in the closed positions these wedges will automatically drop over the four movable die carriage guide rods so as to provide a solid lock for the movable die carriage. The machine is also equipped with the standard locking bars.

The main castings of the No. 8 machine are of high strength Meehanite iron. Such parts as the crosshead, cam, elevator levers, and so on, are of alloy cast steel, heat treated. The movable and stationary die plates have standard mounting provisions for dies and facilities are included for mounting auto-



**Madison-Kipp No. 8 Automatic Die Casting Machine**

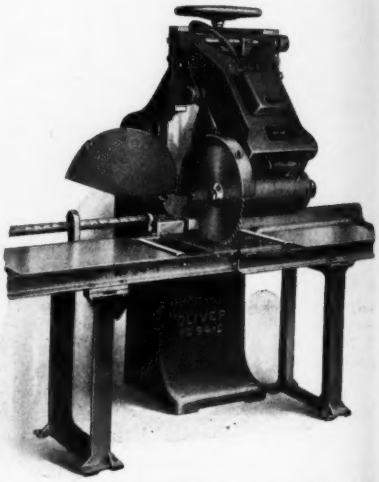
matic ejector mechanism. The Madison-Kipp automatic core pulling devices can be applied to the No. 8 machine. The combination bars on which the core pulling cams are mounted may be placed in various positions on top of the machine and two or more of these combination bars can be used at one time.

The cycle of the machine from open position to the ejection of the casting is entirely automatic. This means that the dies are closed, the cores are put in position, the gooseneck is loaded with metal and brought up to the dies, the casting is shot, pressure is exhausted, the dies are opened, the cores are pulled, and the castings are ejected all with the movement of one operating lever. The standard operating speeds are 5 shots per minute, 3.33 shots per minute, 2½ shots per minute, and 1.66 shots per minute. Other speeds are available by changing the motor drive gears.

Standard equipment includes the 7½ h.p. multi-speed motor, electric control drum, Maxon-Premix gas burner and blower, Barco flexible high pressure joints, air operated wedge locks for movable die carriage, air pressure gooseneck, and a No. 6 Pullmore clutch. Auxiliary equipment includes high pressure air compressors, air receivers, automatic pyrometer control equipment, operator's platform, and so on, which can be furnished as extras.

## Oliver Straitline Cut-Off Saw

Metal tubing, molding, strips of sheet metal and tough alloys, as well as many compositions can be cut with the cut-off saw shown in the illustration. This machine—a product of the Oliver Machinery Company, Grand Rapids, Mich.—is built in two models; one for straight right angle cuts only and the other with swiveled column to make angle cuts up to 45 deg. right and 15 deg. left, pivoting on the line of cut-off gauge, as well as straight right angle cuts.



Oliver Straitline Cut-Off Saw

The machine is equipped with individual motor drive, the fan-cooled motor

being mounted directly on the saw arbor. The machine is designed on the principle of suspended link motion, guaranteeing perfect straight line operation of the saw. The stock is cut with a very light touch and the saw is then automatically returned to its original locked position. The link motion swings in anti-friction taper roller and ball bearings. There are no springs and no counterweights. Pressure gun fittings provide lubrication for all bearings.

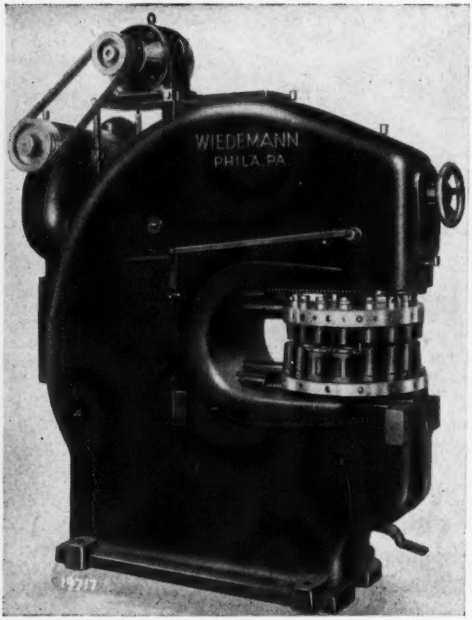
The machine is powered by a 5 hp., 3600 r.p.m., 2 or 3 phase, 60 cycle, 220 or 440 volt, totally enclosed fan-cooled motor. A fan on the motor shaft assures cool and efficient operation. A larger motor can be furnished for unusually heavy service. An automatic starter with magnetic contactor with low voltage protection and overload release and with push button start-and-stop stations is mounted within easy reach of the operator. A flexible cable from the switch to the column completes all wiring, so that the machine is ready to operate as soon as line wires are connected.

The saw arbor is of high grade crucible steel accurately ground where the saw or cutting disk is applied. It is fitted with large collars and will carry dado heads or grinding wheels up to 20 in. wide. Light gauge steel sections having a maximum height of 4½ in. may be cut using the 18-in. metal saw. The machine requires only 18 in. of space from front to back and the total height is 5 ft. 8 inches.

The machine as shown is equipped with Type T automatic cut-off saw table. The table is 18 in. wide x 31 in. high and can be furnished in any length desired. It can be supplied for either right or left hand. The standard table consists of two sections of 8 ft. each, making a total of 16 ft. It is built of channel iron with rigid flange both bottom and top, the table top consisting of steel plates with ball bearing steel rollers mounted between the sections, four rollers to each section.

## Wiedemann Type R-6 Power Operated Turret Punch

Wiedemann Machine Company, 1817 Sedgley Ave., Philadelphia, Pa., has brought out a power operated turret punch to be known as the Type R-6, illustrated herewith. The Type R-6 ma-




**Wiedemann Type R-6 Power Operated Turret Punch**

chine includes the same features of design which characterized the Type R-5 Power Operated Turret Punch which was described in the May 1936 issue of MODERN MACHINE SHOP. Instead of 12 work stations and 12 knock-out dies, however, the Type R-6 machine is built for either 15 or 24 stations and the depth of the throat has been increased to 30 inches.

The Type R-6 can be equipped with standard piercing dies or with special dies for knock-out and similar work. The machine can be furnished with a large metal table, work support, and screw-operated graduated gage bar and stops. The rated capacity of the Type R-6 machine is 80,000 lbs. or the equivalent of punching a 1-in. hole in ½-in. mild steel at a rate of a stroke per second.

## Oilgear 300 Ton Two Column Vertical Speed Press

Compact, sturdy construction with enclosed operating mechanism is featured in this new style 300 ton speed press now being built by The Oilgear Company, 1405 W. Bruce St., Milwaukee, Wis. The main press structure, consisting of the base, side frames, yoke and oil reservoir, is uniformly welded into one compact piece. Two hot rolled heavy steel plates, each having a 34x66 in. cut-out, are used in the front and the back of the press. Corner welds to equally heavy side plates form the rectangular side frame section and the crosshead is also of welded steel construction, accurately guided in the base frame.

Built into the press yoke is a large bottle-type double-acting cylinder with the ram bolted to the crosshead. Two double-acting rapid traverse cylinders, one attached on each side of the crosshead, are concealed in the press frame. A free flow of oil to and from the large cylinder during the rapid traverse cycle is afforded through a large automatic surge valve flanged to the top of the main cylinder.

Pressing the foot pedal causes the crosshead to approach the work rapidly and automatically slow down to the pressing speed as the work is reached. The ram continues downward until the maximum tonnage or positive stops are

reached and maintains the full tonnage on the work until released by means of a foot pedal. Upon release, the crosshead travels upward at rapid traverse


**Oilgear 300 Ton Two Column Vertical Speed Press**

speed and stops automatically. When maximum pressure is exerted, the automatic unloading control reduces the pump stroke to a point just sufficient to maintain the maximum pressure in the system. All control mechanism is concealed in the press frame.

Fluid power operation is provided by an Oilgear Type DP-2025 Pump direct connected to a 20 h.p., 1140 r.p.m., electric motor, the pump and motor being mounted together on the oil reservoir which is welded to the back and top of the frame. The automatic unloading control is adjustable so that the maximum press tonnage can be varied from 60 to 300 tons. Pressing and return

speeds can also be varied to suit the operation.

The capacity is variable from 60 to 300 tons and the stroke is adjustable up to 8 in. The approach speed is 195 in. per minute, the pressing speed is 15 in. per minute and the return speed is 260 in. per minute. Height of base, 29 in. Width between guides, right to left, 24 in. Base, front to back, 30 in. Overall height, 120 in. Floor space required, 60x 58 in. Net weight, 20,500 pounds.

## Colonial Announces Complete Line of Broaching Equipment

A complete line of standard broaching machines and equipment, comprising eleven basic types in 49 different models, has been announced by Colonial Broach Company, 147 Jos. Campau St., Detroit, Mich. The line is designed to provide popular priced standard machinery to cover practically the entire field of broaching, eliminating the necessity for most special designs with their accompanying high cost and low salvage values.

Among the many unusual features of the line is the ability to change machines over easily from one size to another in the event of production changes.

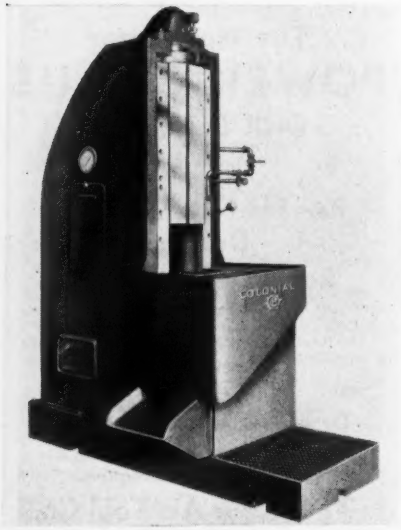



**Fig. 1—Colonial "Single Ram" surface broaching machine available in eleven sizes from six to twenty-five tons.**

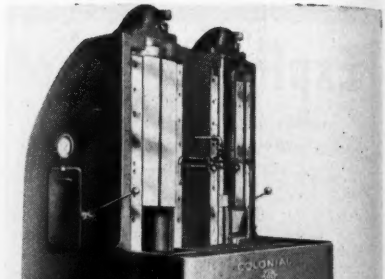



**Fig. 2—The Colonial "Dual Ram" surface broaching machine carries receding tables as standard equipment. Available in eleven sizes and strokes of 36, 48 and 60 inches.**

This has been made possible at a minimum cost, by designing and producing the machines on a unit basis comprising respectively the base, column, and table. Another feature of the line of broaching machines is the attention given to progressive line production broaching. For instance, it is possible to mount several single-ram broaching machines on a single base with continuous feed fixtures.

To facilitate this type of construction, the entire line of Colonial machines is featured by a combination of welded steel and cast iron construction, in accordance with the best design practices. All units are operated through individual motor drives and all models have extra large coolant tanks and pumps. Design of the machines is such that chips do not accumulate around the work or tool, but drop down into large containers, which are easily removable for cleaning. Simplicity of design, construction, and operation has been a major objective throughout. Ways are in all cases made of hardened and ground steel; rams are of semi-steel and of exceptionally rigid construction. All machines are operated through hydraulic pumps, arranged for high cutting speeds and fast returns. In a number of cases variable speed controls are standard

equipment. In most cases automatic lubrication is provided and in all such types, control of the lubricant flow is such as to impart a shot to the ways every cycle of the machine.

Included in the new Colonial line are the following basic types:

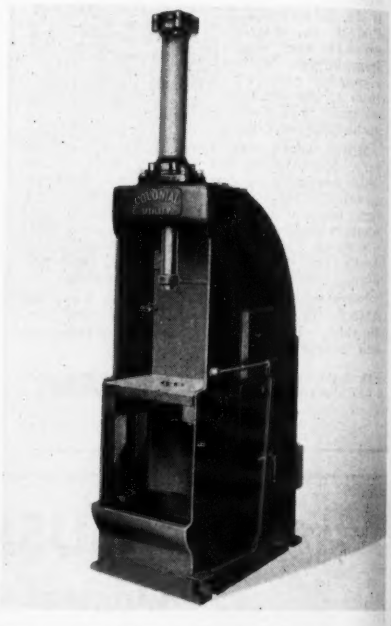


**Fig. 3—The Colonial "Utility" broach is now available in seven sizes ranging from six to fifteen tons in capacity.**

| Type | Series Designation |
|---|---|
| "Single Ram" Vertical Surface Broaching | VA 1 |
| "Dual Ram" Vertical Surface Broaching | VA 2 |
| High Speed Vertical "Pullup" | VC 1 |
| Heavy Duty Vertical "Pullup" | VG 1 |
| "Utility" Vertical Broaching Machine | VB 1 |
| Horizontal Internal and Surface Broaching | HA 1 |
| Horizontal "High Speed Pusher" for Broaching Small Parts | HB 1 |
| Power Presses | VK 1 |
| Light Duty Presses | VF 1 |
| Surface-Broach Sharpening Machine | SFA 36 |
| Cylindrical-Broach Sharpening Machine | SFA 72 |

The two lines of vertical surface broaching machines represent developments from and an expansion of the present line of Colonial single and dual ram types shown in Fig. 1 and 2. They incorporate, however, a considerable number of improvements and refinements, including greater adaptability to line production, the provision as standard equipment of receding tables for work clearance during the return stroke and while loading, a considerable cleaning up in exteriors and a number of important internal operating improvements. These models are now available in tonnages of from six to 25 tons and

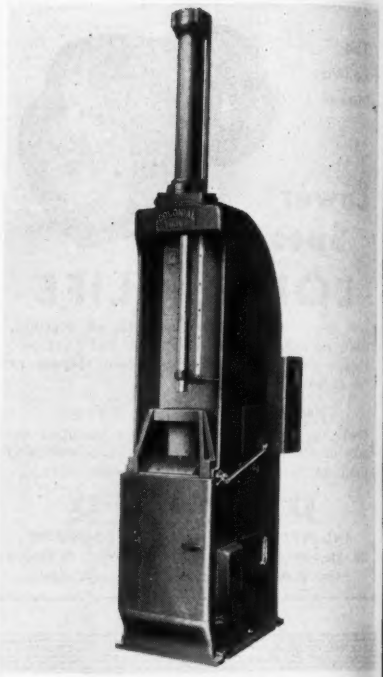


Fig. 4—In the new Colonial "Pullup" line is included the above model for high speed production where fairly light cuts are taken. This machine comes in a 36 inch stroke and capacities from six to fifteen tons.

in strokes of 36 to 60 inches, and will handle surface broaches having a maximum width of 13½ inches per broach.

The Colonial "Utility" broaching line is also a development from a previous series with similar internal improve-

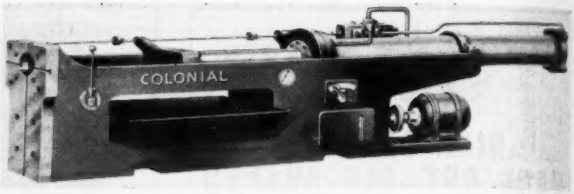
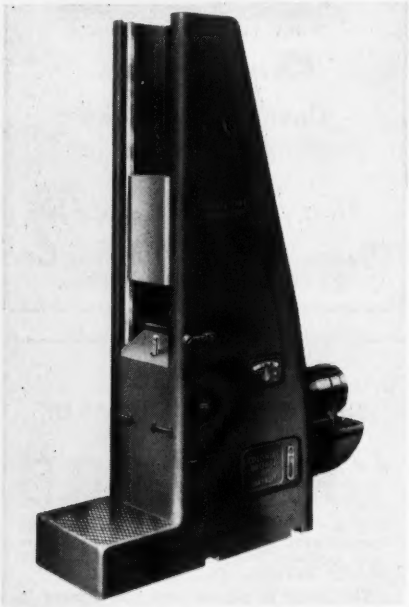



**Fig. 6—The new Colonial "Universal" pull type machine shown at right is adaptable to both internal and surface broaching. This series comes in six models up to twenty tons in capacity and in 48 and 60 inch strokes.**

ments (See Fig. 3). This line is available in from six to 15-ton ram capacity and in strokes of 24 and 36 in.



Another vertical machine designed for internal broaching is the High Speed Vertical "Pullup" (VC-1) series, available in three models, ranging from six to fifteen tons in capacity, with a standard stroke of 36 inches (See Fig. 4). These machines are designed for high speed production of such parts as bushings, the finishing of internal gears, etc.—instances where fairly light cuts are to be taken and a high production rate is demanded. They may be used either as single or twin-broach machines. They are particularly adaptable also to short runs where ability for rapid change-over is essential.

The ram is of the pull type, the machine being equipped with a lower cylinder to handle the broach. Broaching is entirely automatic with this construction, no handling of the tools by the operator being required. Cutting speed is 30 ft. per min. with a 60 ft. per min. return stroke. Drive of the 1,000 lb. pressure hydraulic operating unit is through Vee pulleys and belts from an electric motor mounted in the base of the machine. A feature of this type is that coolant is supplied to both above and below the work and is controlled by a starting handle, the coolant supply stopping when the machine is stopped.

**Fig. 5 (Left)—The heavy duty vertical "Pull-up" is available in ten, fifteen, and twenty ton capacities with strokes of 48 and 60 inches.**

The Heavy Duty Vertical "Pullup" (VG-1) series is complementary to the VC models, being designed for similar work where heavy duty broaching is re-

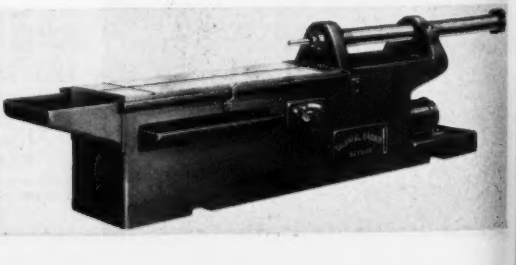


**Fig. 7—This new Colonial "High Speed Pusher" is ideally suited, it is said, for continuous surface broaching of small parts.**

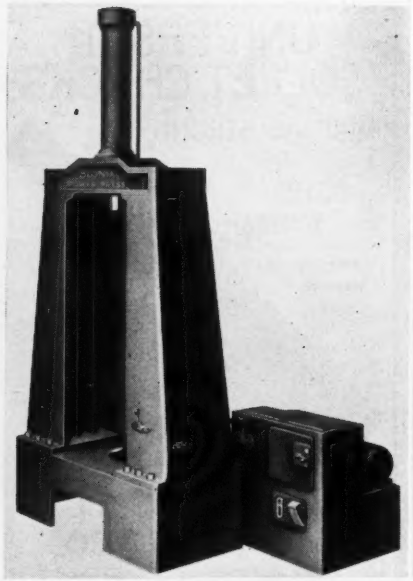


**Fig. 8 (Left)—A complete line of "Power Presses" is available in the new Colonial line. The machines are available in a full range of tonnages and strokes. Fig. 9 (Right)—These "Light Duty" presses in the new Colonial line come in three models of one, two, and four tons respectively. Eighteen inch stroke is standard.**

quired (See Fig. 5). Its application comes in such fields as broaching large gears, long holes, spiral gears, roughing large holes, etc. This type is available in capacities of from 10 to 20 tons and in both 48 and 60 inch strokes. In general design the arrangement of these models closely follows the VC series with the exception, of course, that construction is even more rigid throughout. Variable cutting speed control is incorporated in this machine to provide increased flexibility for a wide range of parts production.

Designated as Universal pull types of horizontal broaching machines the Horizontal Internal and Surface Broach (HA-1) series, (See Fig. 6) comprises six models, available in from six to 20 ton capacities and in 48- and 60-in. strokes. This group is particularly adapted to the broaching of keyways, and round and splined holes. Faceplate capacity is such that the machines can also accommodate a wide range of surface broaching fixtures with tools up to 10 inches in over-all width. Rugged follow rests can be supplied to facilitate handling of extra large broaches.

The standard cutting speed is 30 ft.

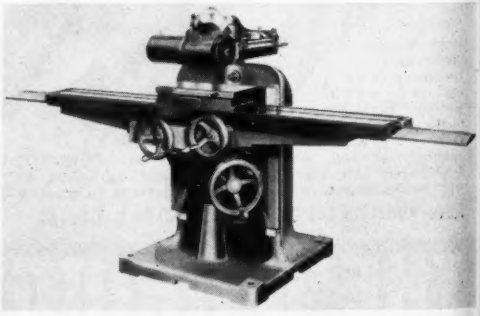


**Fig. 10—For sharpening surface broaches Colonial has developed the above model, notable for its compactness.**

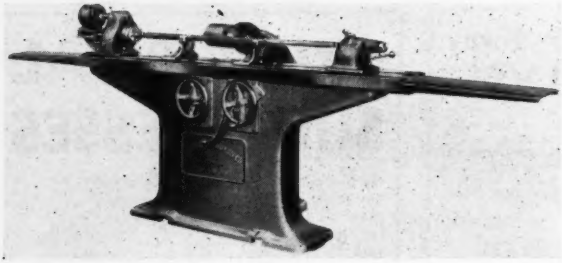
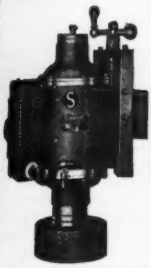


**Fig. 11—This cylindrical broach sharpening machine in Colonial line is said to overcome the usual difficulties in grinding undercuts.**

per min. with a variable speed control as standard equipment, connected to the hand lever. Return stroke is at the rate of 60 ft. per min. Operation is through a 1,000 lb. hydraulic pump driven by a direct coupled motor. Control of the ram is through a 4-way valve located in line with the hand lever control. Coolant supply starts and stops with the machine. This series of models is particularly notable for its simplicity of design and exceptional ease of chip cleaning, as may be noted from the illustration.

Bearing the same relationship to the HA series as does a screw machine to a lathe, the High Speed "Pusher" (HB-1) Colonial horizontal surface push type broaching machine is ideally suited for continuous production of small parts, such as are used in washing machines, typewriters, small automobile parts, etc. (See Fig. 7). Coming in a standard 36-in. stroke, this six-ton model is especially designed for the provision or addition of magazine-feed hoppers. Thus, it makes possible continuous production with a minimum of attention on the part of the operator.

For the broaching of large spiral and straight gears, ring gears, etc., and for large surface broaching up to two feet in width, a line of "Power Presses" of the double column type (VK-1) are provided, available in any capacity (See Fig. 8). Length of stroke is easily variable on this type of construction so that



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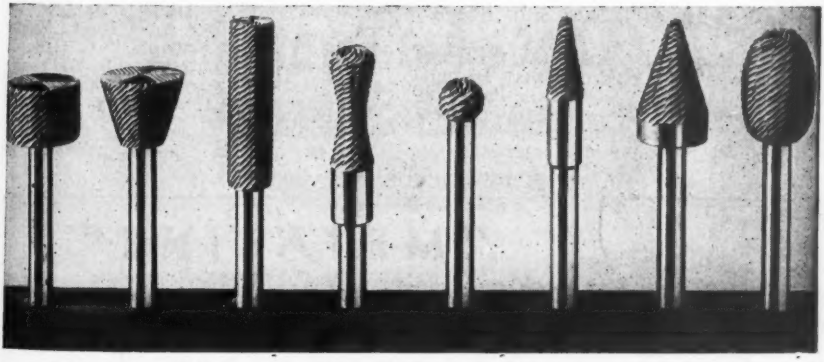
**THE LINCOLN ELECTRIC CO.**
**Department E-278 Cleveland, Ohio**
*Largest Manufacturers of Arc Welding Equipment in the World*

## FORD HAND CUT ROTARY FILES



**Just a few of the many standard shapes which are carried in stock. Write for full information.**

## M. A. FORD MFG. CO.

108 Harrison Street Davenport, Iowa

virtually any length of stroke can be supplied as standard. These power presses are also notable for their simplicity of operation and rigidness of construction. Operation of rams is hydraulic, as in all other Colonial types, with an operating pressure of 1,000 lbs. per square inch.

At the other end of the range, for light shaving with surface type broaches, broaching of small keyways, pressing in all bushings and other assembly work, etc., there is a series of three Light Duty presses ranging from one to four tons in capacity (See Fig. 9). All models of this VF-1 Series are produced with an 18-in. stroke and are also hydraulic power operated.

Included in the new Colonial line of broaching equipment are two new models of broach sharpeners. These new designs are provided with direct drive spindles. Broach-driving head-stocks are driven separately through a two speed gear box, eliminating all belts and pulleys. Special attention has been given in the design of these machines to protect them against grinding dust.

The line comprises model SFA-36 (See Fig. 10) designed for sharpening surface broaches and model SRA-72 (See Fig. 11) for cylindrical broaches. Both types are notable for their simplicity and compactness and are designed to overcome the difficulties inherent in grinding the under-cut associated with the grinding machines commonly used for broach sharpening. The manufacturers claim that a reduction of 2/3 in time required to sharpen broaches is quite common with this type of equipment as compared with the make-shift equipment still in general use.

In addition to the machines included in the new line, the Colonial Broach Company will continue to design and supply special machines for those cases where unusual requirements do not permit the use of standard machines.

## J & L Automatic Thread Grinding Machine

Continuous automatic dressing which keeps the grinding wheel sharp continuously throughout its effective life is the outstanding feature of the J&L Automatic Thread Grinding Machine which has been developed by the Jones & Lamson Machine Company, Springfield, Vt. The machine is designed about the trueing device as the primary element. The trueing device operates with no attention from the operator and without disturbing the size adjustment to which the wheel is continually set. In consequence, metal is removed by a true cutting action in the form of microscopic chips instead of dust; thus a remarkably high rate of metal removal is obtained without burning the work and heavy cuts can be taken without sacrificing accuracy. With a self-trueing, self-sizing mechanism, this thread grinding machine is fully automatic except for putting the work in and taking it out, and the withdrawing of the wheel at the end of the cut. Thus thread-grinding is brought within the range of practical shop operations.

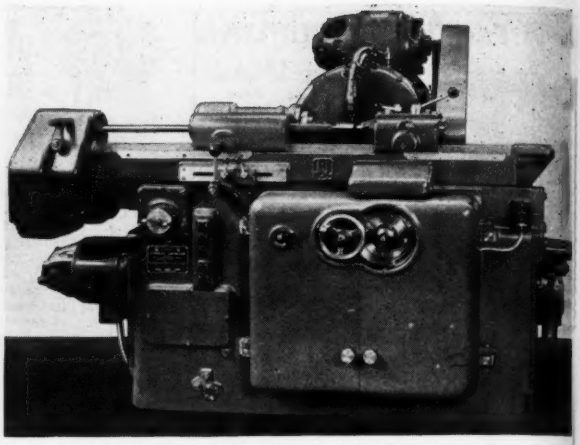
The standard machine is designed to grind up to and including threads 8 in. in diameter and up to and including a maximum thread lead of 9 in., which may be ground on any part of work 24 in. long. This machine will swing work 11½ in. maximum diameter with a maximum work length of 31 in. between centers. The machine spindle is bored 1 11/16 in. in diameter to permit grinding threads up to 1⅝ in. diameter on long work when held in a chuck. Single, double, triple, quadruple, or sextuple threads may be ground within the range of the machine. Grinding wheels of 20 in. diameter are furnished as standard equipment.

The rheostat furnished is graduated to

correspond with graduations on the wheel-trueing device so that, as the wheel decreases in size, the rheostat may be changed to maintain the proper peripheral speed.

The grinding wheel spindle is heat treated, accurately ground and mounted on selected precision bearings. The grinding wheel spindle and motor are mounted on a cradle to permit tilting the wheel any angle up to 15 deg. either way to correspond with the angle on the thread to be ground.

A tapered grinding attachment is another feature of this machine. By inserting a hardened steel former of the desired taper, the machine, without compensation for lead, will reproduce this taper on the work. A standard maximum of 1½ in. of taper may be ground on any portion or over the entire length of 9 inches.



J&L Automatic Thread Grinding Machine

The machine is equipped with a single lever work-speed selector, a choice of 18 feeds forward and 18 reverse being available. When grinding in one direction only, a choice of 75 to 100 r.p.m. for rapid return is available. The grinding wheel feed stops automatically when the correct size is reached and the machine automatically compensates for the decrease in the size of the wheel after trueing.

A standard attachment is furnished for grinding circular chasers, button-type thread hobs, or thread hobs without lead. This device feeds the wheel to depth, then backs it out of the cut. The work is advanced equal to the pitch, then the wheel is fed again to depth. This action is repeated automatically until the work is completed.

For relieving taps and hobs, an attachment is furnished with the necessary

change gears to furnish any amount of relief desired. On taps it is possible to grind any portion of the lands concentric before the relief starts. An attachment for flute jumping automatically speeds up the machine while the wheel is passing over the flute, then slows it down to the correct cutting speed just prior to the wheel meeting the work.

All mechanism in the bed of the machine is lubricated by a filtered splash and spray system. The work spindle drive gears and trueing device run in oil, the trueing device operating under hydrostatic pressure to prevent entrance of grit.

## Quality Multiple Wheel Metal Marking Machine

The Quality Die Company, 9304 S. Baltimore Ave., Chicago, Ill., has brought out a multiple wheel (non-automatic) metal marking machine, illustrated herewith. The machine is particularly suitable for serial marking in steel mills, foundries, forge shops, machine shops and for heavy duty service in production plants. The wheels are of hardened tool steel. The numerical digits are deeply engraved and will stand out on metal up to 415 Brinell hardness. Characters to be stamped can be arranged in a straight line in any combination. Indicators are provided to locate the position for marking, and impressions are made by hammer blow. The changes of serial readings can be made instantly. One wheel can be turned at a time while

**Quality Multiple Wheel Metal Marking Machine**

the others remain locked. Once the serials are selected, all wheels can be positively locked insuring proper alignment. The machines are available with four or more wheels and with figures ranging in size from 1/16 to ¼ in. or over. All mechanism is completely enclosed.





## Vacuum Cup Metal Pulley

Smooth, continuous delivery of maximum power at a greatly reduced belt tension is said to be the feature of the Vacuum Cup Metal Pulley which is now being marketed by Vacuum Cup Metal Pulley Co., 1010 Ford Bldg., Detroit, Mich. The design of the pulley is said to reduce wear on belts, reduce strain and friction on bearings, and prevent unnecessary sudden stresses on the machine, thus increasing the life and efficiency of the equipment.

Vacuum Cup Metal Pulley

Properly spaced and formed vacuum cups distributed over the face of the pulley utilize atmospheric pressure to hold the belt in place as it rides on the revolving pulley face. As the belt surface reaches the cups, the air is squeezed out, thus creating a vacuum in each cup. The suction created holds the belt to the pulley and is said to eliminate the possibility of slippage. Air is admitted to the cups as the belt leaves the pulley, the net result being a smooth, even, positive delivery of power, even under sudden variation in load.

The Vacuum Cup Pulley is claimed to increase the efficiency of the flat belt

for power transmission. The tight stretching of belts is made unnecessary, and the life of the belt is increased. Maintenance costs are reduced through an increase in the life of the motor and bearings. The Vacuum Cup Pulley is said to wear indefinitely. The pulley is available in all standard sizes.

## Hammond Automatic Polishing and Buffing Machine

An automatic polishing and buffing machine built in two types and five models ranging from ½ to 3 h.p. has been announced by the Hammond Machinery Builders, Inc., Kalamazoo, Mich. The ½ h.p. and 1 h.p. sizes—to be known as the JR models—are especially adapted to the speedy handling of light, flat work, such as link pin heads, screw heads, and similar small parts. The 1½, 2 and 3 h.p. sizes—to be known as the JRH models—are designed for handling small die castings, small gears, door knobs, lock parts, light brass parts and other circular work up to 5-in. diameter. The manufacturer states that production on these machines is limited only by the skill and dexterity of the operator, a production as high as 1800 pieces per hour being possible.

Hammond Automatic Polishing and Buffing Machine

The Geneva-rotated work table has eight revolving work spindles which are connected by chain sprocket drives to a ball bearing worm gear reducing unit which is operated by V belt drive from

a motor in the base. This drive permits regulation of indexing and work rotating speeds to meet prevailing conditions. The work table and all shafts and spindles are mounted on dust-proof, grease-sealed ball bearings. All motors are ball bearing and provided with overload protection controls.

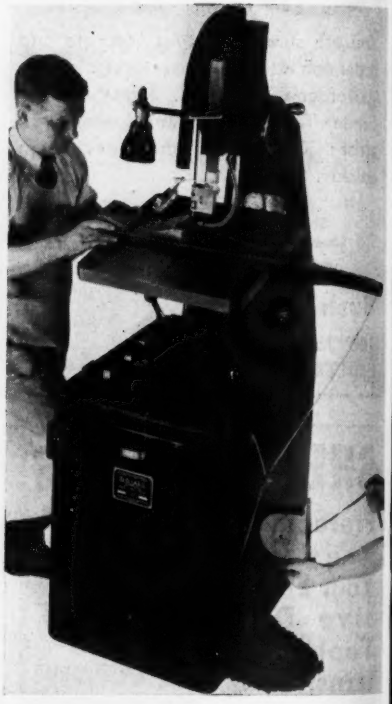
The frame is massive and well-ribbed, provided with the necessary openings to permit of ready access to the operating mechanism. The Type JR motors are fitted with extended spindles held rigidly on columns in horizontal position with a handwheel vertical adjustment. The Type JRH motors have threaded spindle shafts mounted on cross slides with worm gear pivot action. The wheels are hooded and equipped with two-way exhaust heads for carrying off dust.

## Continental Doall Machine Accessories

A power work feed, said to be particularly adaptable to precision sawing requirements, is now furnished with the Continental Doall Machine made by the Continental Machine Specialties, Inc., 1301 S. Washington Ave., Minneapolis, Minn. Power to make the feed effective is delivered through an ingenious application of a spring motor. A heavy coil spring power unit is built into the base of the machine and mounted so that the pull is controlled by means of a foot pedal to permit regulation of the cutting pressure. A constant pressure of 50 lbs. is obtained, subject to foot pedal control, leaving both hands free to guide the work. The noose which grips the work comprises a welded chain which may be unhooked readily.

Another accessory now furnished with the machine solves the problem of cutting true circles of any desired diameter. Inside and outside circle cutting is accomplished by means of an ingenious device built into the work table, compris-

ing a plate having a series of tapped holes to accommodate center pivots. The work is revolved on these center pivots, thus providing a fixed axis that automatically maintains the true circle being cut. This plate slides in the work table in order to provide an adjustable center or pivoting point at any desired distance from the saw; thus the exact diameter for any circle may be obtained.



**Continental Doall Machine equipped with power work feed and magnifying glass. One of the power units is shown held in the approximate position where it is built into the cabinet at the lower right hand side.**

There is practically no limit to the size of the circles that may be cut by this method. The thickness capacity of the machine is 8 in. Inside circles are cut by opening the band saw, putting one end through a starting hole and then rewelding the ends of the saw together in the automatic electric saw brazing unit which is built into the machine.

A magnifying glass also furnished with

**True circles of any diameter can be cut with a special Doall attachment.**

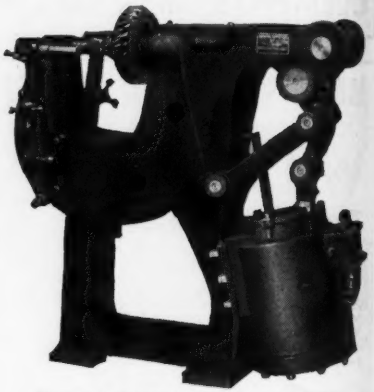
the machine is said to be an important addition. The glass magnifies approximately three times and is large enough in diameter to permit the operator to watch the cutting operation with both eyes thus permitting him to watch the progress of his work and work to extremely fine limits.

## Hanna Differential Squeeze Riveter

The illustration shows the Hanna Differential Squeeze Riveter which has been brought out by Hanna Engineering Works, 1767 Elston Ave., Chicago, Ill. This riveter is equipped complete with

a work holding fixture for supporting the differential assembly while in process, the fixture being adjustable to accommodate various sizes of differentials. The riveter is also equipped with dies and a foot-operated valve. The machine has capacity for driving up to and including 5/8 in. rivets cold.

The "squeeze" method of riveting with cold rivets expands the rivet so that it completely fills the rivet hole in both the hub and the ring gear. There is no shrinkage of the rivet due to cooling,



**Hanna Differential Squeeze Riveter**

and the cost of heating is eliminated. Rivets that are driven cold in this manner remain tight and will not work loose, precluding the possibility of play in the assembly. The machine is shipped as a complete unit ready to install.

## "Smootharc" Welding Electrodes

An entirely new line of coated rods for D. C. welding is now being made and sold through the Harnischfeger Corporation of Milwaukee, manufacturers of P&H-Hansen Arc welding equipment. The present line includes five different types with both high and low rates of fluidity for various types of work in welding in flat, vertical or overhead positions and with ferrous and nonferrous metals. Service tests show tensile strength of welds from 55,000 to 75,000 pounds per square inch with various types of rods ranging from 3/32 in. to 3/8 in. in size. "Smootharc" electrodes are designed primarily to speed up welding operations with a smoother, more easily handled arc and to reduce spatter losses. The new line is described in a new Bulletin (No. R-1), copies of which may be obtained upon request.

## Sheffield Adjustable Plug Gages

Sheffield Gage Corporation, 1513 E. Third St., Dayton, Ohio, announces a line of adjustable plug gages manufactured in two types to provide a complete range of sizes. Figure 1 herewith illustrates the type of gage which can be supplied in any size required up to 4 in.,

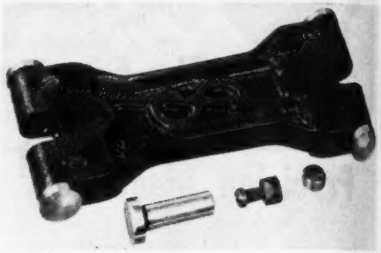


**Fig. 1—Sheffield Adjustable Plug Gage for sizes up to 4 inches.**

and Fig. 2 illustrates the type of gage used for all sizes over 4 in. The two gages cover a range of 23 different standard sizes from a minimum of 2½ in. to a maximum of 12½ in., and special sizes can be supplied upon order.

The frame of the gage is of special heat treated and seasoned alloy iron. The gage may be quickly adjusted to any size within its range. The anvils are locked in position by the use of a lock

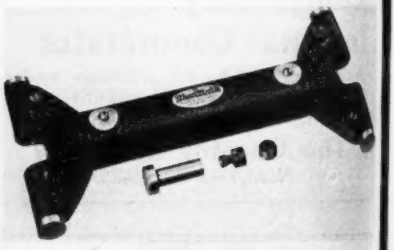
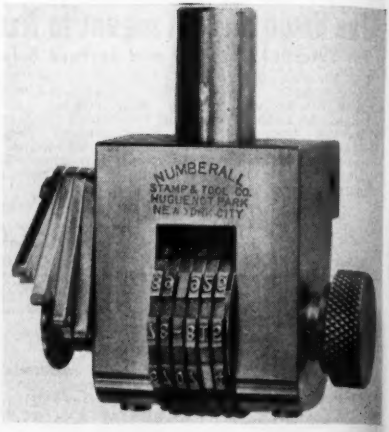


**Fig. 2—Sheffield Adjustable Plug Gage for sizes over 4 inches.**

which utilizes a flat on a bushing which, by screw adjustment, binds against a straight flat on the anvil. This design eliminates any possibility of distortion or sensitive changing adjustment by the anvil shifting backward or forward. Either button or pin type anvils may be supplied. The gages are of convenient design and are finished with a fine crackle finish.

## Numberall Multiple Numbering Machine with Quick Change Feature

To provide a quick acting numbering machine which will be less expensive than an automatic machine and yet more efficient than the usual non-automatic machine, the Numberall Stamp & Tool Company, Inc., Huguenot Park, Staten Island, N. Y., has brought out the Numberall Multiple Numbering Machine with multiple quick change feature shown in the illustration. The machine can quickly be reset by means of the knurled knob and stops on the left.




**Numberall Multiple Numbering Machine with Quick Change Feature**

The wheels revolve both backward and forward and any of the individual wheels can be changed as desired. For numbering jobs involving a multitude of changes, this machine is ideally suited.

## Fulflo Type AG3-M Centrifugal Water Pump

Following the trend toward compact, streamlined design, the Fulflo Specialties Company, Blanchester, Ohio, has brought out the Type AG3-M Centrifugal Water Pump shown in the illustration. This unit is modern in design, construction and performance. Wear on the motor shaft is eliminated by means of a hollow hardened replaceable steel impeller shaft which slips over the end of the motor shaft. Spring tension packing eliminates adjustments and remains tight at all times.


**Fulflo Type AG3-M Centrifugal Water Pump**

The standard unit is built with a cast iron body, a bronze impeller and a priming cover as shown in the illustration. A straight cover, which is optional, can be supplied when gravity feed is used. The unit is powered by a ¼ h.p. splash-proof ball bearing motor at 1725 r.p.m. The pump delivers 25 gal. a minute at a 10 ft. head.

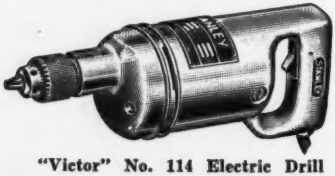
## Bunting Tin Base Babbitt

The line of bearing metals comprising the product of The Bunting Brass & Bronze Co., 735 Spencer St., Toledo, Ohio, has been augmented by the addition of a product to be known as Bunting Tin Base Babbitt. The Tin Base Babbitt is said to have extraordinary qualities for all applications where high speeds, severe vibration, heavy shock and impact loads necessitate the use of metal with high load-carrying capacity and the ability to withstand extreme temperatures. Bunting Tin Base Babbitt is cast in 5-lb. bars, readily divisible.

## "Victor" No. 114 Electric Drill

A lightweight, compact electric drill, known as the "Victor" No. 114, has been added to the line of electric tools manufactured by The Stanley Works, 137 Elm St., New Britain, Conn. The tool has a capacity up to ¼ in. in steel and is equipped with a Universal type motor, operating on either A.C. or D.C. current, 60 cycles or less, and at a load speed of 1500 r.p.m.

A heavy duty, three-jaw chuck is provided for the drill. The motor housing and handle are cast in one piece from a



"Victor" No. 114 Electric Drill

strong aluminum alloy. A rocker motion switch is located in the handle. The "Victor" No. 114 is 12½ in. long and weighs 5¼ pounds.

## Arc Welded Design Chart Announced by Lincoln

A new engineering drafting room chart (illustrated) which presents in concise ready-reference form data necessary for producing arc welded designs is announced by The Lincoln Electric Company, Cleveland, Ohio. The new chart will be found particularly helpful in drafting rooms of companies changing over their products from conventional methods to arc welded construction.

Data given on the chart include: weld symbols for working drawings; illustrations and particulars regarding the 16 types of joints for arc welding; illustrated suggestions for better arc welded design; sketches explaining the nomenclature of welds and weld dimensions; a comparison of welded and riveted drawings: and tables giving properties of base metals, weld metals, electrode metals for hard facing, length of fillet weld to replace rivets, and safe allowable loads for fillet welds in shear.

A feature of the chart, of special interest to companies having large drafting departments, is the fact that it is printed in such a way as to be suitable for blueprinting. This permits making copies of the chart and distributing its essential data to individual draftsmen and others concerned with product design.

The chart is 24 inches wide by 35½ inches high with a metal strip across top and bottom and a clip for attachment to wall.

Engineers or men in charge of drafting rooms may obtain copies by writing The Lincoln Electric Company, Welding Engineering Department E-216, Cleveland, Ohio.

# ARC WELDED DESIGN

## WELD SYMBOLS FOR WORKING DRAWINGS

As Recommended by The American Welding Society, 1930

| LOCATION | FILLET WELDS | BUTT WELDS: REINFORCEMENT | BUTT WELDS: BEVEL |
|---|---|---|---|
| NEAR SIDE | | | |
| FAR SIDE | | | |
| BOTH SIDES | | | |
| ALL AROUND | (Near Side shown) | (Far Side shown) | (Both Sides shown) |

Where the scale of the drawing does not permit the symbol to be shown in place, an arrow should be used with the symbol as in the Examples below

1. Symbol indicates continuous weld unless otherwise noted.
2. Symbol governs welding to a break in the continuity of the weld
3. Size of fillet welds shown thus:
4. Size, length, and center to center spacing of increments in chain intermittent fillet welds shown thus:
   in staggered intermittent fillet welds shown thus:
5. Included angle, opening at root, and location of bevel and reinforcement of butt welds shown thus
6. Welds made during erection shown thus:
7. Definite lengths of fillet welds shown as below:

INTERMITTENT WELDS SINGLE WELDS

8. Welds in large scale in section shown thus:

## ALTERNATE SYMBOLS FOR FILLET WELDS

As Recommended by The American Welding Society, 1930

| LOCATION | NEAR SIDE | FAR SIDE | BOTH SIDES |
|---|---|---|---|
| SYMBOL | | | (If necessary) |

### ABBREVIATIONS
(For use if needed for clarity)

SW – Shop Weld
EW – Erection Weld
CW – Continuous Weld
NS – Near Side
FS – Far Side
BS – Both Sides

METHOD OF SHOWING SYMBOLS ON DRAWINGS

NEAR SIDE FAR SIDE BOTH SIDES

## TYPES OF JOINTS FOR ARC WELDING

BUTT JOINTS TEE JOINTS LAP JOINTS

CORNER JOINTS EDGE JOINT

## NOMENCLATURE OF WELDS

## DIMENSIONING OF WELDS

## PROPERTIES OF BARE METALS

## PROPERTIES OF COATED METALS

## ELECTRODE METALS FOR BARE FUSING

## SUGGESTIONS FOR BETTER ARC WELDED DESIGN

## SIMPLICITY AND LOW COST OF WELDED CONSTRUCTION

WELDED RIVETED

## FOR LOWEST WELDING COST

## LENGTH OF FILLET WELD TO REPLACE RIVETS

## SAVE ELECTRODE LOADS FOR FILLET WELDS

NOTE: THIS CHART CAN BE FOLDED AND SLIDE-PRINTED

"SHIELD-ARC" WELDERS
All Sizes and Types
for Shop Service or Contractors' Service, or Salesmen
Portable or Stationary
FOR EVERY WELDING REQUIREMENT
Write for Latest Bulletins

# THE LINCOLN ELECTRIC COMPANY

Largest Manufacturers of Arc Welding Equipment in the World

CLEVELAND, OHIO

The Lincoln Electric Co. of Canada, Ltd., Toronto, Montreal — Lincoln Electric Co. Ltd., Welwyn Garden City, Herts, England

ELECTRODES, ACCESSORIES AND SUPPLIES FOR EVERY ARC WELDING NEED

Believe in your plans of arc welding are available. If not, name your requirements.

Arc welded design chart announced by The Lincoln Electric Company, Cleveland, Ohio

## "There's One in Every Shop"

*By Wesser*


**H & G INSERT CHASER DIE HEADS FOR B & S AUTOMATICS.** A line of die heads especially designed for use on Brown & Sharpe Automatic Screw Machines and using H & G Insert Chasers is described and illustrated in a four-page folder now being issued by The Eastern Machine Screw Corporation, New Haven, Conn. Copy free upon request.

**"Production Highlights"** is the name of a new monthly bulletin introduced this month by Michigan Tool Company, 7171 McNichols Road, Detroit, Mich. The bulletin is to be devoted to announcements of new products, interesting items on new uses for production equipment, and brief notes of general or specific interest to production men, etc.